Big Brown Bat (*Eptesicus fuscus*) Species Guidance

Family: Vespertilionidae – the evening bats

State Status: Threatened

State Rank: S2S4

Federal Status: None

Global Rank: G5

Wildlife Action Plan Area of Importance Score: None

Range of big brown bat in Wisconsin.
Source: WI Bat Program 2012

Heather Kaarakka, Wisconsin DNR

Dave Redell, Wisconsin DNR

Species Information

General Description: The big brown bat receives its name from its russet to dark brown color, as well as its size relative to other Wisconsin bats. Adults weigh 15-26 g (0.5-0.9 oz), and individual bats' weights vary seasonally and are least in the spring as bats emerge from hibernation (WI Bat Program unpublished data). Adult total length is 110-130 mm (4.3-5.1 in) and forearm length 41-50 mm (1.6-2.0 in; Kurta 1995, WDNR 2009). Wingspan ranges from 32.5-35 cm (12.8-13.8 in) and females are usually slightly larger than males (Barbour and Davis 1969). Dorsal fur is brown to reddish brown and glossy; ventral fur is lighter brown. The skull is larger than other Wisconsin species. The ears are rounded, black in color, naked, and have a rounded tip tragus. Wings, tail membrane, and muzzle are also black and naked.

Similar Species: The big brown bat shares physical characteristics with the hoary bat (*Lasiurus cinereus*) and the silver-haired bat (*Lasionycteris noctivagans*), but close inspection reveals a much duller and solid fur color on the big brown bat with no white-tipped fur. *Myotis* species may be similar in color and form, but big browns can be distinguished by their larger dimensions and broad muzzles. Big brown bats also have a larger tragus and forearms when compared to the evening bat's 34-38 mm (1.3-1.5 in) (Kurta 1995). The big brown bat can also be identified by its echolocation call (Fig. 1), but the silver-haired bat and the hoary bat share similar call characteristics with the big brown bat, and only trained individuals should positively identify bat species through echolocation calls.

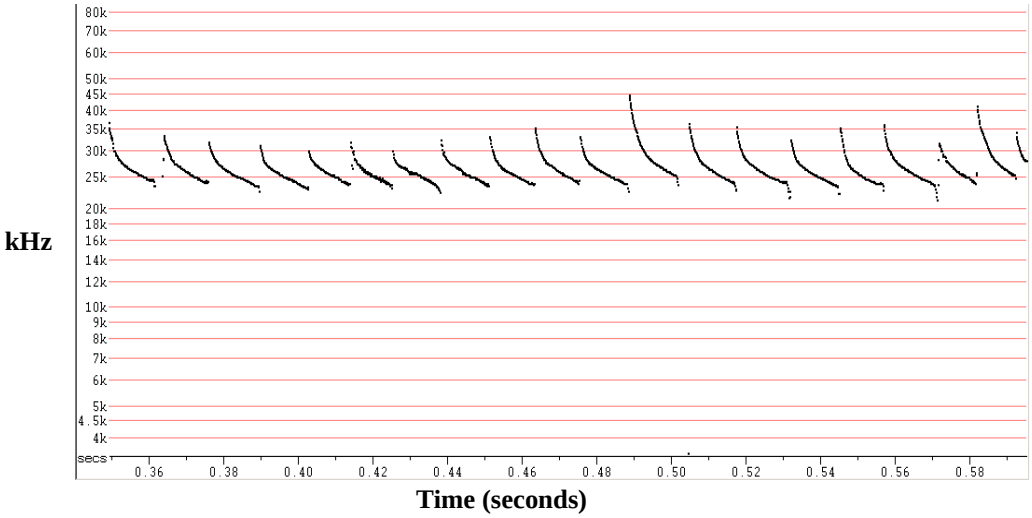


Figure 1. Echolocation call: The big brown bat produces a low-frequency call (20-35kHz). The call's bandwidth is short. Individual calls have a distinctive knee that usually occurs between 25-30kHz. This pattern is similar to that of the silver-haired bat and the hoary bat.

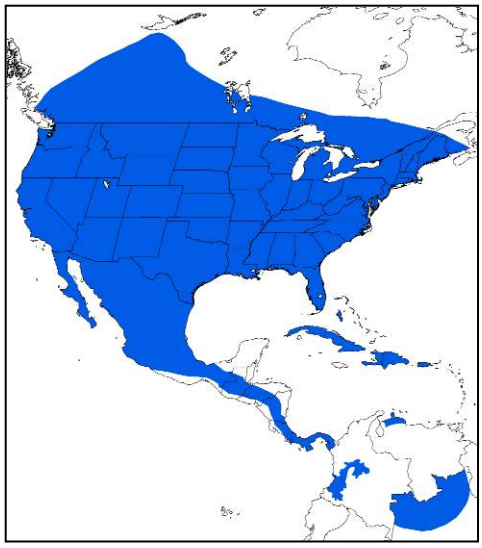
Associated Species: Big brown bat predators include owls, hawks, occasionally snakes, and raccoons (*Procyon lotor*). As many as 13 feral cats have also been observed congregating at a mine entrance at dusk to prey upon bats as they leave the hibernaculum (D. Redell

pers. obs.). Big brown bats often share hibernacula with other bat species such as the tri-colored bat (*Permyotis subflavus*), the northern long-eared bat (*Myotis septentrionalis*) and the little brown bat (*Myotis lucifugus*), but the big brown bat will rarely, if ever, form hibernating clusters with other species. Big brown bats forage with other bat species, but there is no evidence of direct competition between species.

State Distribution and Abundance: Big brown bats are presently common and widespread in Wisconsin and are generally more common in the southern part of the state than in the north (Jackson 1961, WDNR 2013).

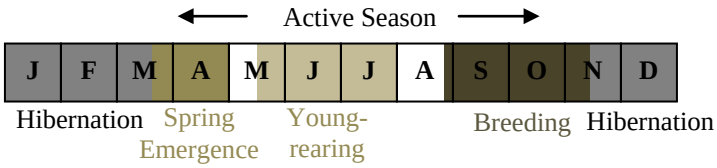
Global Distribution and Abundance: The big brown bat is currently one of the most abundant and widely distributed bats in North America. It ranges from northern Canada, across the continental United States and into Central and South America (BCI 2012).

Diet: Big brown bats are insectivorous, and eat insects from many orders but specialize in beetles (*Coleoptera*) (Whitaker 2004). Other prey include wasps and ants (*Hymenoptera*), flies and mosquitoes (*Diperta*). All prey are caught in-flight using echolocation. Big brown bats may become more beetle-specialist as they mature (Hamilton and Barclay 1998). Regional variation in diet composition exists (Duchamp et al 2007).



Global distribution of the big brown bat. (BCI 2012)

Reproductive Cycle: The big brown bat's reproductive cycle begins in the spring after hibernation, when females become fertilized with sperm they have stored in the uterus over the winter. Reproductive females form a maternity roost with other female conspecifics (members of the same species), and give birth to usually a single pup in June after about a 60-day gestation period (Kurta 1990). Young are naked, blind, and small at just three grams (0.1 oz). The pup nurses for about a month and is left at the roost nightly while the mother leaves to feed (Kurta 1995, Davis et al. 1996). The pup begins to fly and explore on its own at three to five weeks old. Maternity colonies disperse in late July and August, and bats move closer to hibernacula in the fall to mate before they hibernate (Barbour and Davis 1969). Male big brown bats may become mature by their first autumn, whereas females may not reach maturity until after their first year.



Ecology: Male and female big brown bats in Wisconsin begin to leave hibernacula in March and April. During the summer, males are usually solitary while females may form large maternal colonies averaging in size from 20-100 adults in houses or barns. Some males have been observed roosting with females or in all-male colonies (Barbour and Davis 1969). Forest-dwelling reproductive females frequently switch roosts (about every two days, Willis and Brigham 2004). Big brown bats are intolerant of high heat, and mother bats will move their young if temperatures in a roost exceed 32° C (89°F; Davis et al. 1968, Ellison et al. 2007). Another purpose for roost switching may be to maintain a large network of social connections (Willis and Brigham 2004). Maternity roosts usually disband in August and September when bats migrate to their hibernacula. Interannual fidelity to maternity roost sites is common (Kurta 1995).

Big brown bats of both sexes start foraging 20 minutes after sundown unless conditions are rainy, very windy, or below 10° C (50° F). Bats may use night roosts such as barns, shutters, and awnings to rest and digest their meal but return to their day roost by dawn (Kurta 1995). In September and October, big brown bats put on substantial weight to prepare for hibernation. Mating occurs during autumn and early winter during the "fall swarm" when bats congregate at cave and mine entrances before or during the start of hibernation. Sperm is stored in the uterus during winter, and fertilization occurs in the spring when the bats emerge from hibernation. Big brown bat life expectancy is up to 19 years in the wild (Kurta 1995). More research is needed on big brown bats' basic life history and behavior.

Natural Community Associations: (WDNR 2005 and WDNR 2009)

Many bat species are associated more with structural features within natural communities than with any particular natural community or group of natural communities (see "Habitat" section). However, additional research may reveal new information regarding bat species' natural community requirements.

Significant: none
Moderate: none
Minimal: none

Habitat: Big brown bat habitat use changes over the course of the year and varies based on sex and reproductive status. Reproductive females often use different summer habitat from males and non-reproductive females.

Summer: Big brown bats are present in a wide variety of habitats, and are most abundant in farmland, urban areas, and edge habitat near water. Summer roosts occur in crevices and holes of trees or snags or dead-top live trees, caves, and the attics, eaves and walls of buildings (Rancourt et al. 2007). Reproductive females form maternity colonies of 20-100 bats primarily in buildings and bat houses, but they also use tree cavities of beech (*Fagus*), oak (*Quercus*) and aspen (*Populus*) and, rarely, rock crevices (Brigham 1991, Agosta 2002, Duchamp et al. 2007). Structures housing maternity colonies are typically warmer than ambient temperature (outside air temperature), and this elevated temperature helps growth and maturation of the young (Agosta 2002, Lausen & Barclay 2006). Year-to-year summer roost fidelity by females is common (Willis et al. 2003, Duchamp et al. 2007), but bats switch roosts over the summer, particularly when temperatures are high (Kurta 1990, Ellison et al 2007). Males and non-reproductive females roost alone or with a few other males in buildings, trees and rock crevices. Willis et al. (2006) suggests big brown bats choose tree roosts based on the volume of roost cavities in the tree, rather than tree height or stem diameter. Big brown bats may use bridges, buildings, caves, mines, rock crevices or trees as night roosts where they rest and digest for short periods of time. Foraging occurs in forest gaps and riparian areas (Duchamp et al. 2007). Big brown bats prefer to forage in urban landscapes along forest and field edges, over open water and along shorelines (WI Bat Program 2010, 2011, 2012). More information is needed to more fully describe big brown bat foraging habitats and summer roosting in Wisconsin.

Examples of common big brown bat summer roosts: A barn roost in Iowa County (left; Heather Kaarakka, Wisconsin DNR) and a roost in a bat house in Iowa County (right; © Boyd Geer).

Home range: Brigham (1991) found average distance traveled between roost sites and foraging area 1.8 km (1.1 miles), and Brigham and Fenton (1986) found an average distance of 0.9 km (0.5 miles) traveled between roost sites and foraging habitat. More research is needed to accurately describe big brown bat home range.

Winter: Big brown bats hibernate in caves and in man-made structures such as mines, basements, buildings or culverts. Big brown bats are the only Wisconsin bat species known to roost in buildings during winter (all other Wisconsin cave bat species hibernate exclusively underground in caves or mines). Buildings in which big brown bats hibernate remain above freezing through the winter and typically range from 9° to 14° C (48-57° F) (Whitaker 1992). Building use by big brown bats may lower predation risk and save on energy costs (Lausen and Barclay 2006, Duchamp et al. 2007). In cave and mine hibernacula, big brown bats hibernate in areas and sites that are colder, drier, and more exposed to air flow than other Wisconsin bat species. This species occasionally forms clusters during hibernation, but is also found hanging singly from the ceiling or wall. More research is needed to determine what characteristics make caves and mines suitable for big brown bat hibernation.

Big brown bat hibernacula in southwestern Wisconsin: Cluster on a wall in Monroe County (left), and single bat hanging from ceiling in Crawford County. Heather Kaarakka, Wisconsin DNR

Edge habitat (transition zone between two types of vegetation) is important for big brown bats as they migrate and forage. When bats migrate from wintering caves to summer habitat, or commute from roosts to feeding grounds, they move through the landscape in a manner that protects them from wind and predators. Instead of flying the shortest distance across a field, for instance, bats will take longer routes that follow edge habitat. In addition to offering protection, this behavior may also allow bats more feeding opportunities because food is more abundant around edge habitat (Limpens and Kapteyn 1991). Commuting along edge habitat may assist the bats with navigation and orientation through use of linear edges as landmarks (Verboom and Huitema 1997).

Threats: Lack of information on bat species' basic ecology is one of the greatest threats to bat conservation in Wisconsin. The big brown bat faces two emerging threats, and several ongoing threats. White-nose syndrome (WNS) was discovered in 2006 in a hibernaculum in New York State, and appears as a white, powdery substance on the bat's face and body. White-nose syndrome has spread rapidly since 2007 to other hibernacula in neighboring states (USFWS 2012). Infected big brown bat hibernacula in New York and surrounding states have experienced mortality rates of over 90%. White-nose syndrome has been called the "most precipitous wildlife decline in the past century in North America" (BCI 2009), and is caused by a fungus called *Geomyces destructans* (Lorch et al. 2011). This fungus grows best in the cool, wet conditions of hibernacula (Verant et al. 2012). Mortality from the fungus appears to come from increased arousals during torpor, which deplete bats' fat reserves and cause starvation (Reeder et al. 2012) and dehydration (Cryan et al. 2010). For up to date WNS information, see the USFWS WNS website and the USGS National Wildlife Health Center website (see *Linked Websites*). Neither the fungus nor the disease has been found in Wisconsin as of this writing. Cave-hibernating bats, including the big brown bat, should be monitored closely for any indication of WNS; the Wisconsin Bat Program conducts WNS surveillance and monitoring in the state.

Wind power is another emerging threat to bats – wind turbines have been shown to fatally impact all bat species in Wisconsin (Johnson 2003, Arnett et al. 2008). Wind-turbine blades cause mortality through direct impact or through the pressure differential caused by the motion of the spinning blades. This pressure differential causes a bat's lungs to fill with fluid as it flies near the spinning blades, and this phenomenon (known as barotrauma) kills the bat instantly (Baerwald et al. 2008). More research is under way to better understand bat wind-turbine vulnerabilities, but current studies suggest that bats face the greatest risk during migration from summer foraging sites to wintering grounds (tree bats) or hibernacula (cave bats) (Johnson 2003, Kunz et al. 2007). Research is needed on all Wisconsin bat species to better understand wind-turbine mortality in the state and the long term population impacts of turbine-related deaths.

Big brown bats also face the ongoing threat of habitat degradation. Habitat degradation is caused by increased agricultural, industrial, and household pesticide use, and it has negative effects on bats through direct exposure and through dietary accumulation (O'Shea et al. 2001). Pesticides are a threat to many taxa, but bats may be more vulnerable than other small mammals due to certain life characteristics (Shore et al. 1996, O'Shea et al. 2001). Bats' longevity and high trophic level means pesticides can concentrate in their body fat (Clark and Prouty 1977, Clark 1988). Even after pesticide exposure ceases, residues can be passed on to nursing young (Clark 1988). Bat species that migrate long distances may be more affected because pesticide residues become increasingly concentrated in the brain tissue as fat reserves are depleted during long-distance flights. This concentration can lead to convulsions and even death (Geluso et al. 1976, Clark 1978).

Big brown bats also face the ongoing threat of hibernaculum disturbance from humans entering hibernacula in winter and waking bats from torpor. Bats in torpor reduce their metabolism and body temperature to low levels that require less energy than being fully awake. Interrupting torpor costs energy; a little brown bat uses up to 100 mg of fat reserves waking and the returning to torpor (and more if the bat starts flying), or the energetic equivalent of up to 67 days of torpor (Thomas et al. 1990, Thomas 1992). This loss clearly represents a large percentage of total body weight of the bat, and repeated arousals may cause bats to run out of energy reserves before spring arrives and therefore starve in the hibernaculum or die from the elements if they seek food outside (Thomas 1995).

Climate Change Impacts: The effects of climate change on the big brown bat are unclear. Predictions suggest a northward expansion in the ranges of all cave-bat species, in pursuit of optimal hibernation (Humphries et al. 2002, USFWS 2007). This prediction assumes an abundance of suitable caves and other hibernaculum structures further north, but this assumption may not hold for karst-free regions at higher latitudes. Bat species may adapt by reducing torpor depth and duration during winter if prey insect species are available for more of the year (Weller et al. 2009), but bats' adaptive capacities in this regard may be limited and are not well known. Shifts in prey insect emergence may also cause mismatches with bat emergence and cause food shortages in the spring or fall.

Survey Guidelines: Persons handling big brown bats must possess a valid Endangered and Threatened Species Permit. If surveys are being conducted for regulatory purposes, survey protocols and surveyor qualifications must first be approved by the Endangered Resources Review Program (see *Contact Information*).

Acoustic surveys, which should be done by trained individuals, are performed for all Wisconsin bat species in spring, summer and fall, and are used to determine presence/absence, phenology, and distribution around the state. The Wisconsin Bat Program's eventual goal is to use acoustic survey data to determine bat population trends in Wisconsin. Big brown bats are ubiquitous around the state, and therefore surveys can be done wherever suitable habitat exists. Acoustic recording systems that detect echolocation calls can survey bats as they fly through an area. The bat detection system detects and records these acoustic signals as bats fly by, and records the date and time of each encounter. The Wisconsin Bat Program currently uses broadband frequency division ultrasound detection equipment with a PDA (Personal Data Assistant) and a Global Positioning System. Start acoustic surveys half an hour after sunset, but only if the daytime temperature exceeds 50° F, and conduct the survey for at least one hour. There are three seasons for acoustic surveys: spring (April and May), summer (June and July), and fall (August and September). Acoustic surveys record bat passes, which can then be identified to species by trained individuals. These surveys could be used by land managers to create inventories of species distribution and relative abundance. Visit the Wisconsin Bat Program website for additional information.

Wisconsin DNR also conducts a roost monitoring program to determine abundance of bats roosting in buildings and bat houses. People with bat houses or other roost sites identify species and count bats over the summer at night as bats leave the roost. People who find a bat roost while doing field surveys should contact the Wisconsin Bat Program to report the information.

Big brown bats will roost in tree cavities, but such roosts are hard to locate in practice and more information is needed to determine big brown bats' roost preference and conditions of roost trees. Suspected roost trees (see "Habitat" section above) may be identified by sitting at the tree site at dusk and watching for emergence or looking for evidence of bats such as buildup of guano. Known roost trees are of particular importance for both conservation and research purposes and should be avoided. People who find roost trees should contact the Wisconsin Bat Program to report the information.

Summarize results, including survey dates, times, weather conditions, number of detections, detection locations, and behavioral data and submit via the WDNR online report: <http://dnr.wi.gov, keyword "rare animal field report form">

Management Guidelines

The following guidelines typically describe actions that will help maintain or enhance habitat for the species. These actions are not mandatory unless required by a permit, authorization or approval.

Summer Management

Summer roost (see "Habitat" section) availability may limit big brown bat population levels (Fenton & Barclay, 1980), and therefore current summer roost sites should be protected and managed. Big brown bats choose sites based on specific conditions that can be found in both artificial and natural roost settings (bat houses and snag trees). This bat species congregates in large colonies at roost sites to reproduce, and therefore providing safe breeding habitat is one of the best ways to protect this species. Bat houses are an important artificial habitat for big brown bats where females may successfully rear their young in protected conditions. Place bat houses on the south- and east-facing sides of buildings or tall poles. Steps to ensure that a bat house succeeds can be found on the Wisconsin Bat Program website (see *Linked Websites*).

Bats appear to choose natural roosting sites based on the maturity of the forest. Big brown bats seem to choose mature forest because the large trees offer more roosting cavity availability (Williams and Brittingham 1997, Agosta 2002). Research shows that big brown bats use natural tree roosts when building roosts are not available, but it is unclear whether they prefer natural roosts and use building roosts as a result of loss of natural habitat or whether their use of man-made structures is simply exploitation of whatever roosting habitat may be in the area (Brigham 1991, Agosta 2002). Protection and management of mature stands of forest may be the best way to encourage big brown bats to use an area. Forestry management practices that reduce clutter within the forest, such as thinning and burning, and increase edge habitat can encourage big brown bats to forage and roost (Duchamp et al. 2007). Thinning in a southern pine stand led to increased use by big brown bats, which implies that reducing clutter, especially thinning, increases habitat suitability (Loeb and Waldrop 2008). Forested landscapes with a variety of stand types, ages, and management conditions varying in size and topographic location likely provide the landscape elements required to maintain multiple species of bats (Perry et al. 2008).

Linear corridors are important for bat commuting, and forests may be managed such that suitable foraging habitat is connected by corridors; this may include managing edge habitat along roads, logging trails and riparian corridors. Land managers should also make an effort to reduce or eliminate burdock (*Arctium minus*), an exotic weed that produces seeds that trap bats and cause death from exposure.

Special consideration should be given to protecting snags or dying trees, especially those near known roost locations, particularly from June 1 through August 15 while bats may have pups at the roost.

Woodland seasonal pools may be important foraging and water sources for the big brown bat and other Wisconsin bat species because they provide areas for feeding and drinking in an otherwise closed-canopy forest (Francl 2008). Pool size and depth do not appear to determine usage by big brown bats; instead the presence of an opening in the forest is enough to encourage foraging and drinking (Francl 2008).

Fall Management

During fall swarm, large proportions of Wisconsin's cave bat population gather near entrances of the state's hibernacula (see "Habitat" section above), and become concentrated and vulnerable to direct impacts. To avoid disturbance during crucial life history events, management activities such as logging and use of heavy machinery within 0.25 miles of hibernacula entrances should be avoided during fall swarm (August 15-October 15) or during spring emergence (April 1-May 15) because bats may use the surrounding area for roosting during those time periods (USFWS 2007).

Winter Management

Little is known about how big brown bats choose hibernation sites, but suitable Wisconsin hibernacula typically have steady temperatures between 4° C and 12° C (39-53° F), high humidity, and little to no human disturbance. Artificial sites that can mimic this environment may provide suitable hibernacula. Artificial hibernacula include bunkers, food storage-caves and basements. Contact the Wisconsin Bat Program to inquire about developing artificial hibernacula.

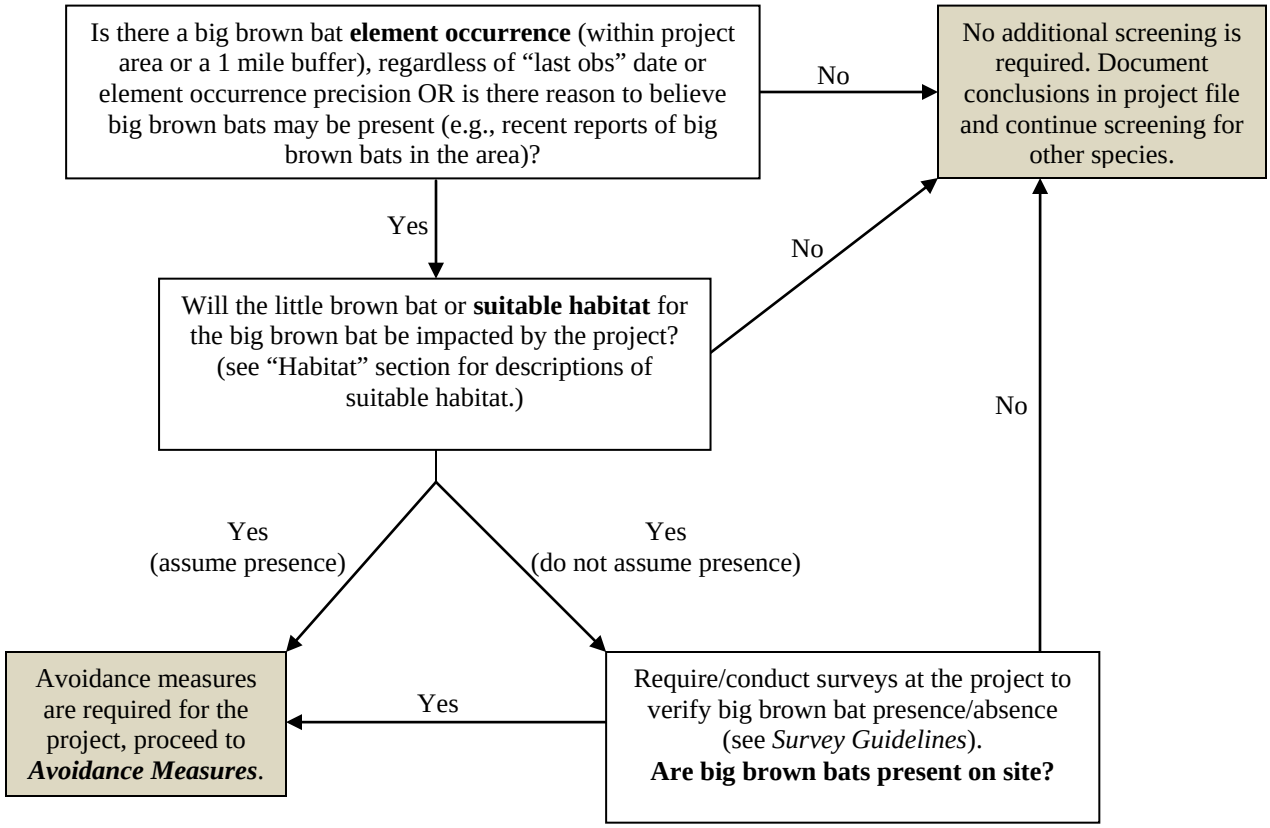
Big brown bats may use buildings as hibernation sites during the winter, especially summer homes that are unheated in winter. Such colonies are normally small (fewer than 30 bats) and inactive, and the best course of action is to leave the colony alone until spring. Big brown bats may become active in the middle of winter during warm bouts, and attempting to exclude the bats (i.e., putting up one-way doors) will trap the bats outside and expose them to the elements. Conduct exclusion in late March through April to evict the bats. If a large number of bats must be removed for health reasons, contact the Wisconsin Bat Program for information on removal and transfer of the colony.

Natural hibernacula can also be managed to encourage bat use. For example, closing but not sealing the entrance to an abandoned mine not only buffers temperature and humidity, but also reduces disturbance from humans and predators. Eliminating disturbance from humans, except for WNS surveillance, is the best management activity for natural cave hibernacula. Contact the Wisconsin Bat Program for more information about managing bat hibernacula. Big brown bats – and their populations as a whole – are particularly vulnerable during winter hibernation because they are concentrated in just a few major hibernacula and because repeated disturbance during hibernation can lead to mortality (see "Threats" section above). Each time a bat is aroused from torpor, it uses up a substantial proportion of the fat reserves it relies on to hibernate through the winter and faces greater odds of starvation before spring (see "Threats" section above). Therefore, avoid entering hibernacula from October 1 through May 15 unless conducting approved and permitted management, surveillance, or research.

Screening Procedures

The following procedures must be followed by DNR staff reviewing proposed projects for potential impacts to the species.

Follow the "Conducting Endangered Resources Reviews: A Step-by-Step Guide for Wisconsin DNR Staff" document (summarized below) to determine if big brown bats will be impacted by a project (WDNR 2012):



Avoidance Measures

The following measures are specific actions required by DNR to avoid take (mortality) of state threatened or endangered species per Wisconsin's Endangered Species law (s. 29.604, Wis. Stats.) These guidelines are typically not mandatory for non-listed species (e.g., special concern species) unless required by a permit, authorization or approval (e.g., forest certification).

According to Wisconsin's Endangered Species Law (s. 29.604, Wis. Stats.), it is illegal to take, transport, possess, process, or sell any wild animal on the Wisconsin Endangered and Threatened Species List (ch. NR 27, Wis. Admin. Code). Take of an animal is defined as shooting, shooting at, pursuing, hunting, catching or killing.

If *Screening Procedures* above indicate that avoidance measures are required for a project, please follow the measures below. If you have not yet read through *Screening Procedures*, please review them first to determine if avoidance measures are necessary for the project.

1. The simplest and preferred method to avoid take of big brown bats is to avoid directly impacting individuals, known big brown bat locations, or areas of suitable habitat (described above in the "Habitat" section and in *Screening Procedures*). The U.S. Fish and Wildlife Services identifies humans and their equipment as possible vectors for spores of *Geomyces destructans* – the fungus that causes white-nose syndrome (WNS) – and therefore simply entering hibernacula at any time of year and moving between them poses threats to bats. Cavers and researchers must observe all cave and mine closures and decontamination protocols (s. NR 40.07, Wis. Admin. Code) (see *Additional Information*). In addition, it is illegal to use pesticides and poisons when attempting to evict bats from house roosts (s. 94.708, Wis. Stats.).

2. If suitable habitat cannot be avoided, follow these time-of-year restrictions to avoid take:

   Summer Avoidance **(June 1-Aug 15)**

   Reproductive females and their young are highly vulnerable to mass mortality during the species' maternity period (June 1 – August 15) because they aggregate in maternity colonies, and because pups cannot fly and therefore cannot leave the roost for several weeks after birth. Many maternity colonies occur in human structures, and those seeking to exclude bats from a building or other roost must follow the Cave Bat Broad Incidental Take Permit and Authorization (see *Additional Information*).

3. If impacts cannot be avoided during restoration or management activities, including wind projects and forestry management, but activities are covered under the Cave Bat Broad Incidental Take Permit and Authorization; the project is covered for any unintentional take that may occur. For information about natural roost avoidance, see *Management Guidelines* and "Habitat" section above.

4. Those seeking to complete wind farm projects should review and follow the Guidance for Minimizing Impacts to Natural Resources from Terrestrial Commercial Wind Energy Development created by the WDNR.

5. If big brown bat impacts cannot be avoided, please contact the Natural Heritage Conservation Incidental Take Coordinator (see *Contact Information*) to discuss possible project-specific avoidance measures. If take cannot be avoided, an Incidental Take Permit or Authorization (see *Additional Information*) is necessary.

Additional Information

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Linked Websites:

- Cave bat Broad Incidental Take Permit and Authorization:< http://dnr.wi.gov/topic/erreview/itbats.html>
- Natural Communities of Wisconsin: <http://dnr.wi.gov/org/land/er/communities/>
- Natural Heritage Conservation Permit Requirements: <http://dnr.wi.gov/topic/EndangeredResources/permits.html>
- Rare Animal Field Report Form: <http://dnr.wi.gov, key word "rare animal field report form">
- USFW WNS Website: <http://www.whitenosesyndrome.org>
- USGS National Wildlife Health Center: <http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/>
- Wind Guidance: <http://dnr.wi.gov/topic/Sectors/documents/energy/WindGuidelines.pdf>
- Wisconsin Bat Program Exclusion Instructions: <http://wiatri.net/inventory/bats/Monitoring/Roosts/docs/BatExclusion.pdf>
- Wisconsin Bat Program: <http://wiatri.net/inventory/bats>
- WDNR Decontamination Protocols for Preventing Spread of White-nose syndrome: <http://dnr.wi.gov/topic/WildlifeHabitat/documents/WNS_DeconProtocols.pdf>
- Wisconsin Endangered and Threatened Species: <http://dnr.wi.gov, key word "endangered resources">
- Wisconsin Endangered and Threatened Species Permit: <http://dnr.wi.gov, key word "endangered species permit">"
- Wisconsin Initiative on Climate Change Impacts: <http://www.wicci.wisc.edu/>
- Wisconsin Natural Heritage Inventory Working List Key: <http://dnr.wi.gov/topic/NHI/WList.html>
- Wisconsin's Wildlife Action Plan: <http://dnr.wi.gov/topic/wildlifehabitat/actionplan.html>

Funding

- Natural Resources Foundation of Wisconsin: <http://www.wisconservation.org/>
- USFWS State Wildlife Grants Program: <http://wsfrprograms.fws.gov/subpages/grantprograms/swg/swg.htm>
- Wisconsin Natural Heritage Conservation Fund
- Wisconsin DNR Division of Forestry

Endangered Resources Review Program Contacts

- General information (608-264-6057, DNRERReview@wisconsin.gov)
- Rori Paloski, Incidental Take Coordinator, Wisconsin DNR, Bureau of Natural Heritage Conservation (608-264-6040, rori.paloski@wisconsin.gov)

Bat Contact Information

- John Paul White, Conservation biologist, Wisconsin DNR, Bureau of Natural Heritage Conservation (John.white@wisconsin.gov)
- Wisconsin Bat Program (608-266-5216, DNRbats@wisconsin.gov)

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Developed By

- Heather M. Kaarakka, Emma M. Pelton, and David N. Redell, primary authors
- Gregor W. Schuurman, primary editor

Wisconsin Department of Natural Resources
Bureau of Natural Heritage Conservation
PO Box 7921
Madison, WI 53707-7921
http://dnr.wi.gov, keyword "ER"