Little Brown Bat (*Myotis lucifugus*) Species Guidance

Family: Vespertilionidae – the evening bats

State Status: Threatened

State Rank: S3S4

Federal Status: None

Global Rank: G3

Wildlife Action Plan Area of Importance Score: None

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

Paul White, Wisconsin DNR

Heather Kaarakka, Wisconsin DNR

Species Information

General Description: The little brown bat is a member of the genus *Myotis*, which is represented by three species in Wisconsin. This bat weighs between 5.5 and 12.5 g (0.19-0.44 oz), and individual bats' weights vary seasonally and are least in the spring as bats emerge from hibernation (WI Bat Program unpublished data). Adult forearm lengths range from 36 to 40 mm (1.4-1.6 in), and total body length is 8.0-9.5 cm (3.1-3.7 in) (Kurta 1995). Adult little brown bat wingspan is 222-269 mm (8.75-10.5 in; Barbour and Davis 1969). Body color ranges from pale tan to reddish to dark brown, and is lighter on the ventral side. Feet have long toe hairs that extend to the tips of the toes.

Similar Species: Three bat species in Wisconsin – the little brown bat, the northern long-eared bat (*Myotis septentrionalis*) and the Indiana (*Myotis sodalis*) bat – are best distinguished by close (in-hand) inspection. The northern long-eared bat has longer ears than the little brown bat, and a pointed, spear-like tragus. Tips of little brown bat ears, when ears are folded alongside the head, should extend no more than 3 mm beyond the tip of the nose; in contrast, the northern long-eared bats' ears extend 3 mm or more. Little brown bat ear length in Wisconsin, however, can be highly variable, and tragus shape and length in relation to the rest of the ear are the two best features to use to distinguish these two species. The little brown bat also appears similar to the Indiana bat, but the little brown bat has long toe hairs that extend beyond the toe, and also lacks the Indiana bat's keeled calcar, a spur of cartilage extended from the ankle and supporting the interfemoral membrane (Barbour and Davis 1969, Fenton and Barclay 1980). Little brown bat fur is also generally glossier and lighter-colored than that of the grayer Indiana bat (see figure 1). The little brown bat can also be identified by its echolocation call (figure 2), but northern long-eared and Indiana bats share similar call characteristics and only trained individuals should positively identify bat species through echolocation calls.

Figure 1. Little brown bat (left) and Indiana bat (right). The little brown bat has a brownish color and a light ventral side. Dave Redell, Wisconsin DNR

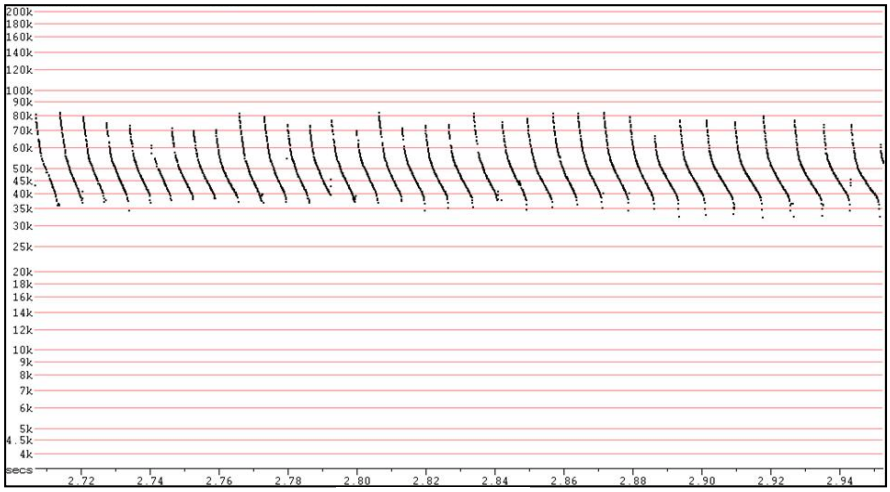
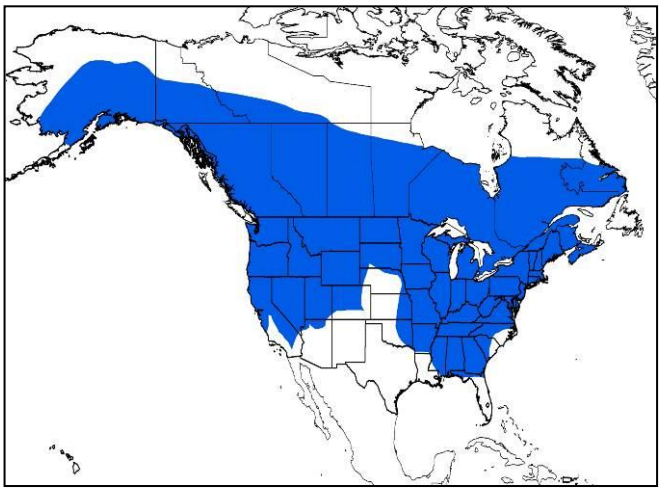


Figure 2. Echolocation call: The little brown bat produces high-frequency calls (40-80 kHz). These bats emit about 20 pulses/second while they search for prey, and when they identify a target and enter the capture phase they increase the rate to 50 pulses/second, to produce a sequence of calls known as the feeding buzz (Fenton and Barclay 1980). The little brown bat sonogram is similar to those of the northern long-eared bat and the Indiana bat.

Associated Species: Little 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 the bats as they leave the hibernaculum (D. Redell pers. obs.). Little brown bats often share hibernacula with other bat species such as the tri-colored bat (*Permyotis subflavus*), the northern long-eared bat, the Indiana bat and the big brown bat (*Eptesicus fuscus*), but the little brown bat will rarely, if ever, form hibernating clusters with other species. Little brown bats forage with other bat species, but there is no evidence of direct competition between species.



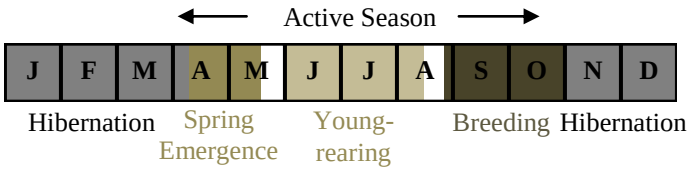
Global distribution of the little brown bat. (BCI 2012)

State Distribution and Abundance: Little brown bats are presently common and widespread in Wisconsin (but see "Threats" section below), and are generally more common in the southern and western part of the state than in the north (Jackson 1961, WDNR 2013).

Global Distribution and Abundance: The little brown bat is currently one of the most abundant bats in North America. It ranges from southern Alaska to the northern part of Florida, and into southern California. It is absent from the middle plains region, Texas, New Mexico and southern Florida (BCI 2012), and is more common in the northern part of its range.

Diet: The Little brown bat is a generalist insectivorous bat. Its diet consists mainly of aquatic, soft-bodied insects such as moths (*Lepidoptera*), wasps (*Hymenoptera*), gnats, mosquitoes, and crane flies (all *Diptera*) (Barbour and Davis 1969).

Reproductive Cycle: The little 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 a single pup in June or early July after a 50- to 60-day gestation period (Wimsatt 1945). Little brown bats rarely give birth to more than one pup. The pup nurses for about a month and is left at the roost nightly while the mother goes out to feed. The pup begins to fly and explore on its own when it is six weeks old. Maternity colonies disperse in late July and August, and bats move closer to hibernacula in the fall and mate before they hibernate (Barbour and Davis 1969). Young-of-year do not usually mate, but some juvenile males appear reproductively active (WI Bat Program unpublished data).



Ecology: Male and female little brown bats in Wisconsin begin to leave hibernacula in April, and often migrate great distances to reach their summer roosting sites and foraging grounds. A study in Kentucky showed that little brown bats migrate six to 280 miles (Humphrey and Cope 1976). Females begin forming maternity colonies in late April and early May. Little brown bats are born between early June and the end of July (but annual variation around this range is typically one to three weeks). Bat phenology (timing of life cycle stages) in northern Wisconsin tends to lag behind that of southern-Wisconsin colonies. Maternity colonies disperse in late July and August, after which bats visit several summer roosting sites before settling on a hibernaculum in which to hibernate from November through April. The little brown bat is long-lived for its size, and lives over 10 years in most cases (Barbour and Davis 1969). Recent identification-band recoveries in Wisconsin found two male little brown bats captured 18 years after banding, and one 25 years after banding (D. Redell unpublished data).

Little brown bats make both short- and long-distance migrations in the spring to their summer foraging ranges and maternity roosts, and they return in the fall to their hibernacula. Many return to the same site year after year. More research is needed on little 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: Little 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: Little brown bats commonly roost in human-made structures, but have also been found in the summer under tree bark, in rock crevices, and in tree hollows (Humphrey and Cope 1976; Fenton and Barclay 1980). Male and female little brown bats both prefer old-growth and mature trees because they provide more crevices and cavities (Fenton and Barclay 1980, Crampton and Barclay 1998). Reproductive females form maternity colonies in buildings, bat houses, and tree hollows and select sites based on ambient temperature and shelter. These colonies usually number 300-1200 bats (adults and offspring), but can reach up to 3000 (Humphrey and Cope 1976). Maternity colonies are usually located near water where little brown bats prefer to forage. These colonies do not occur in caves or mines (reproductive females and their young need warmer temperatures), but larger maternity colonies tend to be close to hibernacula, presumably because the bats do not need to travel very far to reach them after hibernation (Humphrey and Cope 1976). Reproductive female little brown bats prefer hot and humid roosting sites in summer, with roost temperatures ranging from 23.3° C to 34.4° C (Burnett and August 1981) or as much as 8° C to 10° C above ambient temperature (Brittingham and Williams 2000). In Illinois, maternity colonies of little brown bats may be found in natural roost sites such as oak (*Quercus spp.)* and maple (*Acer spp)* trees in both upland and bottomland hardwoods (Bergeson et al. 2012). These colonies are found in dead or dying trees about 8 m off the ground in crevices or hollows or rarely under loose bark (Bergeson et al. 2012). Males often roost alone, and do not share maternity colonies' high-temperature needs (Fenton and Barclay 1998). Males may use tree crevices, buildings and occasionally caves and mines as day roosts (Fenton and Barclay 1980). Both sexes choose roosts based on proximity to water, because the bats prefer to forage over open water or near shorelines and along edge habitat (Fenton & Barclay, 1980). Males often roost alone or with a few other males in summer and choose a variety of roost sites. This species chooses day roosts based on temperature and degree of shelter. Roosts are often in confined spaces that may help bats prevent heat loss, and also may be chosen by proximity to foraging habitat (Fenton and Barclay 1980). They tend to choose old growth forest over younger stands because the reduced understory clutter of the old growth forests makes prey easier to find and capture (Crampton and Barclay 1998). More information is needed to accurately describe little brown bat foraging habitats and summer roosting in Wisconsin.

Home range: Female little brown bats have small summer home ranges of 32-64 acres, and lactating female bats have smaller ranges than non-reproductive females (Jackson 1961, Henry et al. 2002).

Winter: Little brown bats hibernate during winter in humid caves and mines with constant temperatures (Barbour and Davis 1969, Humphrey and Cope 1976). This species often forms clusters of both sexes during hibernation. More research is needed to determine what characteristics make suitable caves and mines for little brown bat hibernation.

Figure 3. Inhabited summer roost habitat in Wisconsin (Photos a,b). The dark color of the bat houses helps them heat up during the day, and bat houses retain the heat after the sun sets (b). Little brown bats using a bat house in Lafayette County (c), © Kent Borcherding, and Yellowstone Lake State Park bat houses in Lafayette (b), © Kent Borcherding. A little brown bat hibernaculum (mine) in Pierce County (Photos c,d). Large room with clusters (c), Heather Kaarakka, Wisconsin DNR, and single bats hanging from ceiling (d). Tyler Brandt, Wisconsin DNR

Edge habitat (transition zone between two types of vegetation) is important for little 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 little 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 little 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 *Additional Information*). Wisconsin's little brown bat population is particularly vulnerable to WNS because almost all of the state's little brown bats concentrate each winter in a few large hibernacula. Neither the fungus nor the disease has been found in Wisconsin as of this writing. Cave-hibernating bats, including the little 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.

Little 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).

Little 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 little 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 little 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. Little brown bats are ubiquitous around the state, and therefore surveys can be done wherever standing water or edge 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 surveys should contact the Wisconsin Bat Program to report the information.

Little brown bats will roost in tree cavities, but such roosts are hard to locate in practice and more information is needed to determine little brown bats' roost preference and conditions of roost trees. Suspected roost trees (see "Habitat" section) 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 little brown bat population levels (Fenton & Barclay, 1980), and therefore current summer roost sites should be protected and managed. Little 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 habitat is one of the best ways to protect this species. Bat houses are an important artificial habitat for little 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 *Additional Information*).

Bats appear to choose natural roosting sites based on the maturity of the forest. In particular, little brown bats are found roosting in old stands significantly more often than in younger stands presumably because old stands offer more opportunities for roosting in cavities (Crampton and Barclay 1998). Protection and management of old stands of forest may be the best way to encourage little brown bats to use an area. Forestry management practices that reduce clutter, such as thinning and burning, within the forest and increase edge habitat can encourage little brown bats to forage and roost (Duchamp et al. 2007, Hayes & Loeb 2007). 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 little 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 little 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), 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 surrounding area for roosting during those time periods (USFWS 2007).

Winter Management

Little is known about how little 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 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.

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

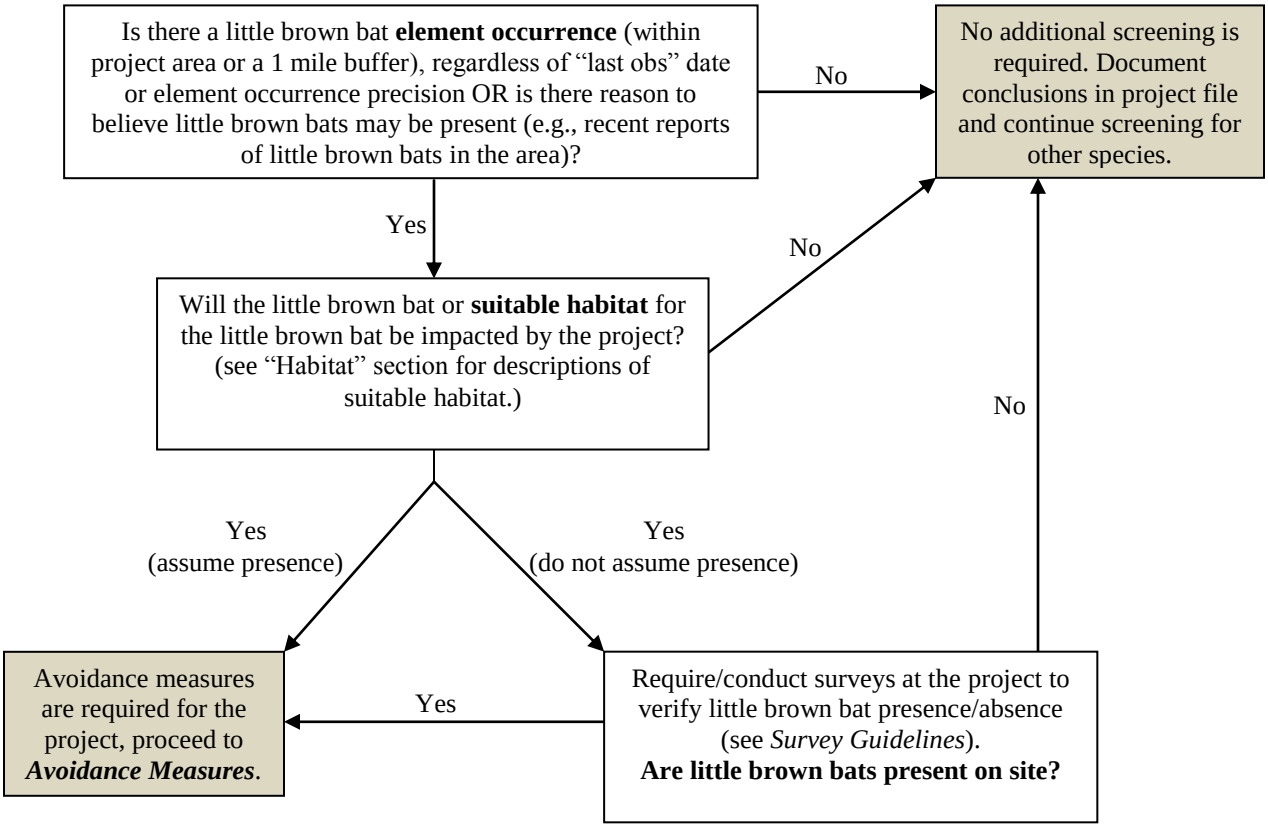
from humans, except for WNS surveillance, is the best management activity for natural cave hibernacula. Contact the Wisconsin Bat Program for more information about managing bat hibernacula.

Little 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 little 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.

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, 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 little brown bats is to avoid directly impacting individuals, known little

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 little 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.

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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"