



United States Department of the Interior

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MEMORANDUM

To: Jack Arnold, Acting Assistant Regional Director, FWS, R4, ES, Atlanta, GA

Through: Dave Flemming, Ecological Services Program Supervisor, FWS, R4, ES, Atlanta, GA *D. Flemming* 11/3/15

From: Virgil Lee Andrews, Jr., Field Supervisor, FWS, R4, ES, Frankfort, Kentucky *Virgil Lee Andrews, Jr.*

Subject: Final Biological Opinion for Section 10(a)(1)(A) Activities Conducted for Federally Listed Bats in the Southeast Region

This document transmits the biological opinion of the Fish and Wildlife Service (Service) based on our review of the issuance of permits by the Service's Southeast Region (Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Puerto Rico, Virgin Islands) under section 10(a)(1)(A) of the Endangered Species Act, and its effects on the endangered Indiana bat (*Myotis sodalis*), gray bat (*Myotis grisescens*), Virginia big-eared bat (*Corynorhinus townsendii virginianus*), and Ozark big-eared bat (*Corynorhinus townsendii ingens*) pursuant to section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

This biological opinion is based on information provided by the Service's field offices in Jackson, Mississippi; Daphne, Alabama; Asheville, North Carolina; Athens, Georgia; Cookeville, Tennessee; and Frankfort, Kentucky; and other sources including Service species lead field offices in Bloomington, Indiana (Indiana bat), Elkins, West Virginia (Virginia big-eared bat), Columbia, Missouri (gray bat), and Tulsa, Oklahoma (Ozark big-eared bat). A complete administrative record of this consultation is on file and available for review at the Kentucky Ecological Services Field Office, 330 West Broadway, Room 265, Frankfort, Kentucky 40601.

Consultation History

On July 29, 2009, The Service's Southeast Region held a White-nose Syndrome (WNS) conference call to provide an opportunity for dialog between the many agency partners potentially affected by the progress of the syndrome. A question was raised during this conference call regarding the need for separate Section 10(a)(1)(A) permits from the Service for the disposition of carcasses, including those of listed bat species. The Service's response was to

begin working preemptively on Section 10(a)(1)(A) permits for actions that are and will be needed in the Southeast Region to address WNS.

During the next few months, the Service began compiling a list of bat research and potential WNS related activities that would require a Section 10(a)(1)(A) permit.

On September 11, 2009, the Service agreed that there was an immediate need for a programmatic intra-Service formal consultation to address issuance of listed bat permits, especially those involving WNS-related activities. During this process, the Service also re-evaluated how traditional bat research, recovery, and scientific collection activities are addressed by issuance of Section 10(a)(1)(A) permits. As a result, the Service decided to include all traditional bat research, recovery, and scientific collection activities in the programmatic consultation as well as certain WNS-related activities (see Description of the Proposed Action section, number 11 below) that overlapped with the traditional activities or were deemed necessary under this consultation.

The Tennessee Ecological Services (ES) Field Office (TFO) agreed to take the lead on drafting the programmatic biological opinion with assistance from the Regional Office and the Kentucky ES FO (KFO). Shortly after initiating work on the biological opinion, the KFO assumed lead field office responsibilities in the Southeast Region for the gray bat, Indiana bat, and Virginia big-eared bat, and a regional WNS coordinator was hired and located at the KFO. At that point, the lead for drafting the biological opinion shifted to the KFO.

The KFO circulated a draft version of the biological opinion to affected field offices in the Southeast Region and received comments from several field offices. Based on that information, the final biological opinion was drafted and submitted to the Service's Assistant Regional Director, Ecological Services, Southeast Region on July 21, 2010 via email to Dave Flemming, ES Program Supervisor of the KFO. Since that time, revisions to the proposed action have occurred and other modifications were made to the biological opinion and incorporated into the revised final biological opinion.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Service's Southeast Region regularly receives applications for permits and issues permits, pursuant to Section 10(a)(1)(A) of the Endangered Species Act, for recovery-related take of listed bats caused by presence/absence surveys, population surveys, banding efforts, and other recovery activities. These applications are from various individuals, academic institutions, environmental consulting firms, and other organizations. Each permit undergoes review in the Southeast Region and by biologists at field offices in states where the activities will occur. Permitted activities that cross into other regions of the Service are coordinated with the respective regional offices. Permits also undergo public review through the Federal Register. Before issuing a permit, the Service must consider issuance criteria at 50 CFR 17.22(a)(2) or 17.32(a)(2). This process takes some time to complete and the lack of a programmatic consultation on these permitting efforts has often delayed important survey work and studies that

might contribute to the recovery of the four federally-listed bat species shown in Table 1 below that are likely to be adversely affected by the proposed action.

Therefore, the purpose of this biological opinion is to address the effects of the Southeast Region’s issuance of Section 10(a)(1)(A) permits that contain specific recovery-related activities on these four federally-listed bat species. This biological opinion is needed so that the review and processing of Section 10(a)(1)(A) permits can be facilitated so that the permitted activities proceed in a manner that is both timely and results in minimum adverse effects on the four bat species. These activities would only be authorized in the Southeast Region in areas known or believed to be within the ranges of the four bat species covered by this biological opinion (i.e., the action area)¹.

Table 1. Federally-listed bat species that are likely to be adversely affected by the issuance of Endangered Species Act Section 10(a)(1)(A) permits in the U.S. Fish and Wildlife Service’s Southeast Region

Common Name	Listing Status	Species in Action Area	Species Will Be Adversely Affected
Gray bat	Endangered	Yes	Yes
Indiana bat	Endangered	Yes	Yes
Virginia big-eared bat	Endangered	Yes	Yes
Ozark big-eared bat	Endangered	Yes	Yes

The specific activities that would occur relative to the four bat species covered by this biological opinion include the following:

- 1. Installation of remote bat detection equipment, including acoustic monitoring systems to record bat vocalizations** – During this activity, the detection system (e.g., beam-break movement detection instruments or acoustic call monitoring and recording equipment) is placed in a particular location (e.g., often just inside the entrance of the cave or attached to the cave gate, if present). This could occur during the period when bats are actively flying and foraging, but it could also occur during the hibernation period to detect bat activity during the normal hibernation season. Therefore, this activity can also be considered a WNS surveillance and monitoring measure. Also, the deployment of this equipment would be accomplished by a permitted biologist. This activity does not require the capture and/or handling of individual bats but could harass listed bats that are

¹ Applications submitted to the Southeast Region for Section 10(a)(1)(A) permits that include the proposed activities in this biological opinion and/or other proposed activities and that request authorization for work that will be done (a) on other listed bat species and/or (b) in areas outside of the Southeast Region (i.e., other Service regions) will undergo additional coordination and consultation with species lead field offices and regional offices.

roosting and/or hibernating due to these disturbances during installation and maintenance of the equipment.

2. **Entry of hibernacula or maternity roost caves** – This activity involves entering a hibernaculum during the winter months or a maternity cave or other roost during the summer to conduct population estimates or to collect samples (e.g., wing punches, hair samples, etc.). This will include WNS-related surveillance and monitoring activities. Estimating numbers in the roost does not require handling of bats but can result in harassment of listed bats. For example, bats may leave their perch and fly through the cave, thereby expending energy otherwise reserved for natural arousals between torpor events. The significance of this disturbance is largely site specific and is dependent upon many factors (e.g., number and amount of time surveyors are present in the site, number of bats present, winter vs. summer, location of roosts, etc.).
3. **Salvage of dead bats** – This activity involves the removal of dead bats that are occasionally observed at summer roosts, elsewhere on the landscape during the non-hibernation period, or in hibernacula. These salvaged individuals, which may be WNS infected, would be retained, stored for a period of time, preserved by freezing or chemical means (if necessary), transported or shipped to the testing or research laboratory, and used by the testing or research laboratory or other appropriate researcher or facility for necropsy and determination of cause of death. This activity does not require capture and/or handling of live bats, but it can result in harassment if the salvaged bats are found in association with other listed bats, such as with an existing maternity or roosting colony.
4. **Harp trapping and mist netting during non-hibernation seasons** – This activity involves the temporary installation and monitoring of harp traps and mist nets at locations where bats can likely be captured. A harp trap consists of an array of monofilament fishing line stretched within an aluminum frame. A cloth or plastic catchment bag is placed at the bottom of the frame, and the trap is placed in the opening of a cave or other potential roost. Bats fly into the monofilament lines and fall into the catchment bag where they remain temporarily until removed and processed. Because captured bats are collected in a single catchment bag, harp traps tend to result in greater physical contact between bats while they are in the traps, which may lead to an increased risk of WNS transmission between bats.

Mist nets consist of thin monofilament or nylon mesh line. The mist net is placed between vertical poles and is set in locations of probable bat activity (e.g., across a stream, road, or other corridor opening; near a known roost; etc.) Several panels of nets are typically stacked so that the net fills the corridor likely used by bats (e.g., the opening from the ground or surface of the stream to the lower edge of the forest canopy). Mist nets are set at dusk and are typically left up for five or six hours; however, shorter timeframes are likely in certain situations (e.g., mist netting near a known roost). Bats often avoid the nets but some fly into the net and become entangled. Some individuals are able to free themselves, but typically they become more entangled as they struggle. They remain in the net temporarily until removed, held individually in small bags (i.e.,

less chance of WNS transmission) and processed (i.e., maximum 30 minute hold time from capture to release).

Harp traps and mist nets are used to collect bats for various purposes such as presence/absence surveys, collection of hair or guano samples, and to band or place transmitters on individual bats. All of these activities require handling of bats. During handling, bats are removed carefully by hand from harp traps and mist nets to avoid injuring the bats. Nets and traps are left unattended, but are checked at regular intervals (e.g., 15 minutes) to ensure that bats are not trapped for long periods of time. Both of these activities may involve WNS infected bats.

5. **Collection of data from individual bats** - This activity is usually conducted during harp trapping, mist netting, or by hand in winter and/or summer roosts. Data collected normally includes a combination of species name, determination of sex, band information, wing damage, weight, forearm length, and reproductive condition. Certain WNS-related samples may also be taken including swabbing the bat or using fungal lift tape to obtain fungal spore samples that can then be analyzed to detect or screen for the fungus that causes WNS. These samples will be stored, preserved (if necessary), transported or shipped to the testing or research laboratory, and used by the testing or research laboratory or other appropriate researcher or facility for WNS detection purposes. Collectively, these actions are minimally invasive to bats; however, temporary handling of individual bats is required for each activity, and this activity may involve WNS infected bats.
6. **Collection of fecal material** – This activity involves the collection of fecal material that is found in association with communal roosts or that is excreted when bats are collected using harp traps, mist nets, or by hand in winter and/or summer roosts. This fecal material can be collected, stored, preserved (if necessary), transported or shipped to the testing or research laboratory, and used by the testing or research laboratory or other appropriate researcher or facility for various scientific studies (i.e., food habits) and for genetic sampling. This activity does not necessarily require the capture and/or handling of live bats, but it can result in harassment if the collection is taken near other listed bats or during trapping efforts. It may also involve WNS infected bats.
7. **Hair clipping** – This activity involves the collection of hair from bats captured during mist netting, harp trapping, or by hand in winter and/or summer roosts. A small amount of hair is clipped from the back of the bat for contaminant or isotope analyses, genetic evaluation, or other scientific purposes. The hair samples will then be stored, preserved (if necessary), and transported or shipped to the testing or research laboratory or other appropriate researcher or facility that will conduct the specific analysis. Handling of individual bats is required and may involve WNS infected bats.
8. **Banding** – This activity involves the placement of a small, numbered, metal band around the forearm of a bat that has been captured during mist netting, harp trapping, or by hand in winter and/or summer roosts. This allows researchers to track seasonal movements. Handling of individual bats is required and may involve WNS infected bats.

- 9. Attachment of radio transmitters or light tags to bats** – In this activity, bats are collected using harp traps, mist nets, or by hand in winter and/or summer roosts. A small patch of hair is shaved from the back of the bat, and a dermal adhesive is applied to the skin. The transmitter or light tag is then attached, and the bat is released. Transmitters remain attached to the bats for several days, during which time researchers can track nocturnal movements and locate diurnal roosts. For light tags, a fluorescent light stick is attached to the bat instead of a radio transmitter to allow for short-term tracking of nocturnal movement and foraging activity. The adhesive used to attach light tags is designed to release the tag after only a few hours. The use of light tags has been helpful during the development of acoustic bat call libraries (e.g., Anabat). This activity requires capture and handling of individual bats and may involve WNS infected bats.
- 10. Collection of wing punches for genetics studies and other analyses** – In this activity, bats are collected using harp traps, mist nets, or by hand in winter and/or summer roosts. A medical biopsy tool is used to obtain a small sample (i.e., typically two to five millimeters in diameter) of skin by punching a hole in the wing membrane, avoiding bones and major blood vessels. This activity is typically conducted in order to obtain samples for genetics or contaminants analyses. The wing punches will then be stored, preserved (if necessary), and transported or shipped to the testing or research laboratory or other appropriate researcher or facility that will conduct the genetic or contaminants analysis. This activity requires the handling of individual bats and may involve WNS infected bats.
- 11. Selective euthanasia of listed bats for WNS testing** – In this activity, listed bats that are moribund due to WNS or showing advanced symptoms of WNS are collected for analysis. Collection will typically be done by hand due to the condition of the bats and because the symptoms of WNS are typically exhibited during the hibernation season. However, listed bats may occasionally be collected via other means. Collected bats will be euthanized in sealed plastic bags by over-dosing with an isofluorene-soaked cotton ball or similar method. Collected bats will then be stored, preserved (if necessary), and transported or shipped to the testing or research laboratory or other appropriate researcher or facility that will conduct the necessary WNS analysis. This activity requires the handling of individual bats and will involve WNS infected bats. Listed bats will only be collected if (a) the site of collection has not been previously demonstrated to contain WNS-infection or WNS-infected bats (listed and/or non-listed), (b) no other non-listed bats are present that also show symptoms of WNS, and (c) no other method of WNS sample collection is possible. In addition, only one listed bat of any species will be collected at a single roost site and only if criteria (a), (b), and (c) are met and those circumstances documented by the permittee in writing to the Service. When multiple listed bat species are present within a site and showing symptoms of WNS, the following order will be used in selecting which individual to selectively euthanize for WNS testing: gray bat before Indiana bat before Virginia big-eared bat before Ozark big-eared bat.
- 12. Receipt of dead bats, bat genetic material, and other samples lawfully collected by authorized third parties** – This activity involves the receipt, storage, handling, study,

and analysis of dead bats, bat genetic material, and other listed bat-related samples by authorized biologists, researchers, and testing, research, and other facilities that process, evaluate, and study such materials. These materials will be provided by other listed bat permittees, can involve WNS infected bats, and do not include live bats.

Prior to issuance of permits for the above-listed activities, a separate evaluation of the effects and the incidental take statement would be completed by the permit review staff in the Southeast Region to ensure that the permitted activity is in compliance with the provisions of this biological opinion.

White-nose Syndrome (WNS) Implications

White nose syndrome (WNS) was first discovered in caves with hibernating bats in New York during the winter of 2006. Since then, the disease has spread to at least eleven other states (Virginia, West Virginia, Pennsylvania, Massachusetts, Vermont, New Hampshire, Connecticut, New Jersey, Tennessee, Maryland, and Delaware) and has been responsible for the deaths of over one million bats, including endangered Indiana bats. The disease was first reported in the Service's Southeast Region in early February 2010 at Worley's Cave in Sullivan County, TN. Since that time, WNS has also been documented at Dunbar Cave in Montgomery County, TN (approximately 280 miles west of Worley's Cave).

In addition, bats testing positive for the fungus that leads to WNS (i.e., *Geomyces destructans*) have been found in 1 hibernaculum in western Pennsylvania, 3 hibernacula in Tennessee, 2 hibernacula in Missouri (northeast and southeast), 1 hibernaculum in northwestern Oklahoma, and 1 hibernaculum in Virginia. However, bats at these locations did not exhibit signs of the fungal infection characteristic of WNS positive locations, nor was mortality or other visible signs of WNS detected at these locations. A total of nine species have been confirmed positive for *Geomyces destructans* and/or the fungal infection. Six of these species have been documented to both have the fungus and suffer the fungal infection characteristic of WNS disease [i.e., little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*), eastern small-footed bat (*Myotis leibii*), Indiana bat, tricolored bat (*Pipistrellus subflavus*), and the big brown bat (*Eptesicus fuscus*)]. During the winter of 2010, three new species of bats were confirmed positive for the fungus through laboratory testing [i.e., The federally endangered gray bat was confirmed positive in Missouri; the cave myotis (*Myotis velifer*) was documented positive in Oklahoma; and the southeastern bat (*Myotis austroriparius*) was positive in Virginia]; however, these species do not appear to have suffered the fungal infection that is characteristic of WNS disease in the northeastern U.S. as of the date of this biological opinion.

To date, WNS has not been reported as affecting the gray bat, Ozark big-eared bat, or Virginia big-eared bat. During the winter of 2010, WNS was documented in Hellhole Cave in West Virginia. Hellhole Cave is the most populated hibernaculum for Virginia big-eared bats; however, Virginia big-eared bats have not been documented to be affected by WNS within this cave. WNS is spreading within the range of the Virginia big-eared bat, but has not yet reached the range of the Ozark big-eared bat.

WNS is expected to spread further into the Southeast, Midwest, and Western United States into the foreseeable future. If infected endangered bats are observed, permits will be required to

collect live, sick, or dead individuals to be sent for testing. For activities that would involve potential death or injury to bats (incidental take), permits will also be needed for WNS research opportunities and any management opportunities that will present themselves as this disease continues to spread across the Southeast into hibernacula of previously unaffected species (e.g., gray bats, Virginia big-eared bats, and Ozark big-eared bats).

A variety of WNS-related activities may be proposed as part of planned surveillance, monitoring, and response measures for WNS. Many of the proposed activities discussed above are expected to have a WNS surveillance, monitoring, and/or response component and would, therefore, be an integral part of any WNS project or program implemented by states or the federal government. Permits will be needed for these activities, so this biological opinion will facilitate issuance of permits for the proposed activities discussed above that are taken in association with WNS surveillance, monitoring, and response. WNS-related activities that are different from the actions outlined above are not covered by this biological opinion and would, therefore, need to undergo a separate effects analysis prior to section 10(a)(1)(A) permitting of any such action(s).

Protective Measures

The proposed activities can be categorized as listed below. These descriptions of the categories of activities highlight the measures that are incorporated in the activities for minimizing adverse effects and take of the four bat species. In addition, the standard permit provisions contained in Appendix A will apply to these actions, which will also help minimize adverse effects to the four species.

1. Activities that do not involve handling of live listed bats – This category would include four activities described above: (a) entry of roosts for visual counting and inspection, (b) monitoring via electronic equipment in caves, (c) salvage of dead bats, and (d) collection of fecal material (where handling is not necessary). Activities (a) and (b) involve the permittee entering roosts where listed bats are known or may occur but do not involve the handling of listed bats. Activities (c) and (d) involve the collection of dead bats and fecal material for use in research and WNS surveillance. The period of time that listed bats are exposed to noise, light, or other forms of disturbance during hibernation or other roosting activity is minimized during these activities in an effort to reduce unnecessary energy expenditure by listed bats and subsequent loss of fat reserves. In addition, the receipt of dead bats, genetic tissues, and other samples would not involve any additional direct or indirect adverse effects; however, listed bats may be disturbed while these activities are conducted.
2. Minimally invasive activities that involve handling of listed bats and a low potential for physical injury to listed bats – This category includes a broad range of activities including: (a) harp trapping and mist netting during non-hibernation seasons, (b) collection of data from individual bats (e.g., species, sex, band data, wing damage, weight, forearm length, and reproductive condition), (c) collection of fecal material (when it involves handling), (d) hair clipping and shaving, and (e) banding. Each of these activities involves the direct handling of listed bats, which may result in short-term harassment of listed bats and the potential to harm listed bats while they are handled. The period during which bats are handled is minimized in an effort to reduce stress and the potential to harm listed bats. Also, the amount of collected material (e.g., hair) is

minimized to the amount necessary to conduct the needed analysis. These activities have been undertaken by existing and previous permittees with little apparent effect on listed bat populations.

3. Invasive activities which will cause or have the potential to cause direct physical injury or mortality to listed bats and/or an extended period of harassment – These activities include wing punches, the attachment of transmitters, and selective euthanasia of listed bats showing advanced symptoms of WNS. Each of these activities involves the direct handling of listed bats and is expected to result in long-term harassment and/or harm and/or mortality to listed bats. To minimize the effects of these activities, (a) Bats are held for the minimum amount of time necessary to collect samples or attach transmitters; (b) The smallest amount of material necessary is collected via wing punches; (c) Transmitter weights are minimized and matched to the weight of the bat to which it will be attached (i.e., smaller bats carry smaller transmitters); (d) Euthanasia would only be applied to individual bats that are moribund due to WNS or showing advanced symptoms of WNS and using measures that will significantly reduce the number of listed bats taken (see “Description of Proposed Action” criteria in 11 above) and that are known to reduce pain and suffering of the euthanized bat(s); and (d) These activities utilize standard protocols that have been used for many years and that are known to minimize physical and behavioral effects (e.g., wing punch activities are completed at the end of hibernation to minimize stress to bats during hibernation).

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/critical habitat description

Gray bat: The gray bat was listed as an endangered species on April 28, 1976 (41 FR 17736). No critical habitat was designated for the species.

The gray bat is the largest member of the genus *Myotis* in the eastern United States (USFWS 1982). Forearm lengths range from 40 to 46 millimeters and individuals weigh from 7 to 16 grams. This species is easily distinguished from all other bats in the eastern United States by the color of its fur. All other species have bi-colored or tri-colored fur. In late summer, the gray bat’s fur is uniformly dark gray, but the color may bleach to chestnut brown or russet between molts (USFWS 1982). Also, the wing membrane of gray bats connects to the foot at the ankle rather than at the base of the first toe as in other *Myotis* species (USFWS 1982). The Service’s Missouri Field Office has completed a 5-Year Review (USFWS 2009b) for the gray bat that contains additional information on the current status, threats, and life history of the species, and the 5-Year Review is hereby incorporated into this biological opinion by reference.

Indiana bat: The Indiana bat was listed as an endangered species on March 11, 1967 (32 FR 4001). Critical habitat was designated as follows (41 FR 41914):

Illinois - The Blackball Mine, LaSalle County

Indiana - Big Wyandotte Cave, Crawford County; Ray’s Cave, Greene County

Kentucky - Bat Cave, Carter County; Coach Cave, Edmonson County

Missouri - Cave 021, Crawford County; Cave 009, Franklin County; Cave 017, Franklin County; Pilot Knob Mine, Iron County; Bat Cave, Shannon County; Cave 029, Washington County

Tennessee - White Oak Blowhole Cave, Blount County

West Virginia - Hellhole Cave, Pendleton County

The Indiana bat is a medium-sized member of the genus *Myotis* (USFWS 2007). Forearm length ranges from 35 to 41 millimeters and total body length ranges from 41 to 49 millimeters. It closely resembles the little brown bat, but differs in having a distinctly keeled calcar (a cartilaginous structure extending from the ankle toward the tail). Also, the ears and wing membranes have a flat coloration that does not contrast with the fur (USFWS 2007).

On 15 April 2007, the Service released the *Indiana Bat (Myotis sodalis) Draft Recovery Plan: First Revision* (USFWS 2007), which contains a summary of the current status of the Indiana bat. In addition, the Service's Indiana Field Office recently completed a 5-Year Review of the Indiana bat (USFWS 2009a), which summarizes the current status of the species, progress towards recovery, and remaining threats to the bat. The draft recovery plan and 5-Year Review are available at <http://www.fws.gov/midwest/Endangered/mammals/inba/index.html> and are hereby incorporated by reference.

Virginia big-eared bat and Ozark big-eared bat: The Virginia big-eared bat and Ozark big-eared bat were listed as endangered species on December 31, 1979 (44 FR 69206). Critical habitat was not designated for the Ozark big-eared bat, but the following critical habitat was designated for the Virginia big-eared bat (44 FR 69206):

West Virginia - Cave Mountain Cave, Hellhole Cave, Hoffman School Cave, Sinnit Cave; Pendleton County; Cave Hollow Cave; Tucker County

The Virginia big-eared bat and Ozark big-eared bat are two of five subspecies of Townsend's big-eared bat (USFWS 1984). They are medium-sized bats with large ears measuring more than one inch in length that are connected across the forehead. Adults weigh from five to 13 grams and are similar in appearance to Rafinesque's big-eared bat. They can be distinguished from the latter using fur color of the belly, chest, and back. The fur on the chest and belly of Townsend's big-eared bat is tan and the dorsal fur is brown; Rafinesque's has white fur on the underside and gray fur on the back (USFWS 1984).

The West Virginia Field Office completed a 5-Year Review (USFWS 2008a) that contains additional information on current status, threats, and life history of the species, and the 5-Year Review is hereby incorporated into this biological opinion by reference. Similarly, the Oklahoma Field Office completed the Ozark big-eared bat Revised Recovery Plan (USFWS 1995) and Ozark big-eared bat 5-Year Review (USFWS 2008b), and these documents are hereby incorporated into this biological opinion by reference.

Life History

Information on the life history of the four bat species is contained in the recovery plans, 5-year reviews, and published and unpublished literature for the species. This information is adequately described in those documents and is hereby incorporated by reference (see References).

Population Dynamics

Gray bat: Since the completion of the 1982 Gray Bat Recovery Plan and the 1991 5-year review, ongoing surveys have been undertaken throughout the species' range. Counts have been conducted at hibernacula and maternity sites, and there have been surveys conducted for the species associated with various development projects. Depending on the situation and season, different techniques have been used to monitor various gray bat populations including direct counts, emergence counts and measuring the extent of guano piles or ceiling stains at established roosts. More recently, species' numbers have been monitored using technologically advanced equipment such as near-infrared (NIR) or thermal infrared (TIR) videography with computer and statistical software packages. In addition to problems inherent with using various census techniques, other complications associated with differences in observers' counting abilities, movements of gray bats between transient and permanent hibernacula or maternity sites, seasonality (e.g., counts at maternity sites before or after birth of young), inability to census sites the same year, and the potential of disturbing hibernating bats at critical hibernacula, all further hamper the ability to obtain accurate population trends for the species. The difficulty in obtaining meaningful trend data for various species of bats including *Myotis grisescens* has been exhaustively examined (Tuttle 1979; Sabol and Hudson 1995; Ellison et al. 2003, Kunz 2003, O'Shea and Bogan 2003, Tuttle 2003, Martin 2007, Sasse et al. 2007, Elliott 2008). Despite these limitations, various analyses have recently been conducted to assess changes in the population levels of gray bats since the recovery plan for the species was completed in 1982.

Ellison et al. (2003) of the U.S. Geological Survey (USGS) developed an extensive bat population database for 45 species of bats known from the United States, including the gray bat. From this database, the authors statistically analyzed 1,879 observations of gray bats obtained from 334 roost locations (103 summer colonies and 12 hibernacula) in 14 south-central and southeastern states. These authors reported upward, downward, or no trends for all sites analyzed. The Service interpreted an upward trend to be defined as an increasing population, a downward trend to be defined as a decreasing population, and no trend to be defined as a stable population. This follows terminology used in analysis of the status of gray bat populations in the western portion of the species' range by Sasse et al. (2007). Ellison et al. (2003) determined that 94.4% (85.4% no trend; 9% upward trend) of the populations showed stable or increasing populations while 6% revealed a decreasing population. Stable or increasing populations were reported for 83% (58% no trend; 25% upward trend) of the 12 hibernating colonies examined. For populations where there was a downward population trend, decreases in population numbers were mostly attributed to on-going problems with human disturbance.

Sasse et al. (2007) analyzed data from 48 gray bat maternity sites involving three subpopulations in Missouri, Arkansas, and Oklahoma between 1978 and 2002, and calculated that 79% of the colonies were stable or increasing. Elliott (2008) examined population trends of gray bats at nine, Priority 1 caves and concluded that although the species had increased by approximately 21% between 1980 and 2005, it had only reached roughly 37% of its maximum historic

populations at these sites. Martin (2007) compiled a rangewide exhaustive review of gray bat hibernacula and maternity sites and summarized conservation actions that had been undertaken and suggested steps that were necessary to achieve full recovery. Based on general population trends across the range of the species, Dr. Michael Harvey of Tennessee Technological University has attempted to estimate changes in the species status. He reported that the species increased from approximately 1,575,000 to roughly 2,678,000 in 2002 and to approximately 3,400,000 in 2004 (see Ellison et al. 2003 and Martin 2007). Martin (2007) noted that gray bat population levels have increased approximately 104% since 1982.

Wide population fluctuations of gray bat numbers have been documented at many maternity sites across the species' range, but there have been significant population increases in some of the major hibernacula. Martin (2007) noted that gray bat populations exhibited increases at Coach Cave, Kentucky from 0 in 1995 to 337,750 in 2007; at Blanchard Springs Caverns, Arkansas from 33 in 1985 to 128,005 in 2006; at Cave Mountain Cave, Arkansas from 205 in 1988 to 139,740 in 2006; and at Bellamy Cave, Tennessee from 347 in 1965 to 139,364 in 2006. Similarly, Martin (2007) and Elliott (2008) reported that populations of gray bats at Coffin Cave, Missouri increased from an estimate of 250,000 in 1977-79 to 561,000 bats in 2005. Although increases at some hibernacula may be due to movements from other caves [e.g., possible shift of bats from Jesse James Cave to Coach Cave after air flow was restored in the latter cave (Richard Clawson, pers. comm. 31 July 2009)], gray bat populations have increased and recovered in many areas throughout the species' range (Tuttle 1987; Harvey and Britzke 2002; Ellison et al. 2003; Tuttle and Kennedy 2005; Martin 2007; Sasse et al. 2007).

Indiana bat: On 15 April 2007, the Service released the *Indiana Bat (Myotis sodalis) Draft Recovery Plan: First Revision* (USFWS 2007), which summarizes the current status of the Indiana bat. Since the April 2007 release of the Draft Recovery Plan, the Bloomington, Indiana Field Office (BFO) has collated the population data gathered during the 2007 and 2009 biennial winter hibernacula surveys and preliminarily determined that the Indiana bat's 2009 range-wide population stands at approximately 390,000 bats, which is a 16.6% decrease over the 2007 range-wide population estimate of 468,000 bats (USFWS, unpublished data, 2010). The range-wide, biennial population estimates had been increasing since at least 2001, indicating that the species' long-term decline had been arrested and likely reversed (USFWS, unpublished data, 2010). The observed range-wide decline in 2009 is partly attributable to WNS, especially for decreased population estimates in the Northeast. The species' range-wide, regional, state, and hibernacula-specific population trends are being closely monitored by the BFO.

Given the 2009 range-wide Indiana bat population estimate of approximately 390,000, we assume that there are approximately 2,438 to 3,250 maternity colonies within the species' range [assuming a 50:50 sex ratio (Humphrey et al. 1977) and an average maternity colony size of 60 to 80 adult females (Whitaker and Brack 2002)]. At present, the Service has location records for approximately 269 maternity colonies (USFWS 2007), which, based on the assumptions above, represents 8 to 11% of the assumed number of maternity colonies in existence.

Virginia big-eared bat: The range-wide population of Virginia big-eared bats currently is considered stable. The range-wide population of Virginia big-eared bats is estimated to be approximately 15,000 bats. Approximately 12,000 of these bats hibernate in West Virginia. The 2009 maternity counts in West Virginia were the highest on record (7,245) and the 2010 count documented 7179 bats, the second highest count on record (WVDNR 2009; Stihler, pers. comm.). Four genetically-distinct sub-populations of Virginia big-eared bats occur in northeastern West Virginia/northwestern Virginia, southern West Virginia, eastern Kentucky, and western Virginia/North Carolina (Piaggio 2009). Throughout this range, there are only 13 caves that have been documented to support groups of more than 20 hibernating Virginia big-eared bats, and only eight that have supported groups of more than 100 individuals. There are only 17 caves known to be used as maternity sites and six other caves that are known to support summer bachelor-colonies composed of more than 20 individuals.

The northeastern West Virginia/northwestern Virginia region, which encompasses Tucker, Pendleton, and Grant counties, West Virginia and Highland County, Virginia, supports the largest population segment. Caves in this region support approximately 77% of the range-wide maternity population (USFWS 2008a, USFWS 2008b). Over 60% of the range-wide population hibernates in these counties. Almost all of these bats (10,025 as of 2010) hibernate in a single location - Hellhole Cave. There are five caves (Hellhole, Hoffman School, Cave Mountain, Cave Hollow/Arbogast, Sinnitt/Thorn Mountain) designated as critical habitat under the Endangered Species Act. All are located in this region of West Virginia. The area encompassed by all the hibernation and maternity caves in this region is approximately 30 miles long and 36 miles wide. There are only three caves located outside of West Virginia that support more than 100 hibernating Virginia big-eared bats (USFWS 2008a). These caves are located in Tazewell County, Virginia; Avery County, North Carolina; and Lee County, Kentucky.

Ozark big-eared bat: The Ozark big-eared bat is endemic to the Ozark Highlands and Boston Mountains ecoregions (Omernik 1987) where it occurs in oak-hickory hardwood forests (Clark 1991; Leslie and Clark 2002; and USFWS 1995). The current range of the Ozark big-eared bat includes northeastern Oklahoma and northwestern Arkansas. In Oklahoma, Ozark big-eared bats currently are known to occur in Adair, Cherokee, and Sequoyah counties. They were historically known from two caves in Delaware County, but have not been observed there recently. Twelve caves considered essential for the continued existence of the Ozark big-eared bat (*i.e.*, used by colonies of Ozark big-eared bats for maternity sites and/or hibernacula) occur in Oklahoma. In Arkansas, the Ozark big-eared bat is known to occur in Marion, Washington, Searcy, Crawford, and Franklin counties. Seven essential caves occur in Arkansas.

At the time of listing, the Ozark big-eared bat was known from only a few caves and the entire population was estimated to consist of about 100-200 individuals. Since listing, additional caves used by maternity colonies in the summer and as hibernacula have been discovered in Oklahoma and Arkansas. Ozark big-eared bat populations at essential hibernacula and maternity sites are monitored using minimal census techniques to obtain estimates on colony size and population trends. The population is estimated to currently consist of about 1,800 individual bats with about 1,300-1,400 individuals in Oklahoma and 400-500 in Arkansas. Census counts through 2009 indicate that the overall population has experienced a slightly increasing trend since 1997, when the last discovered essential maternity site from which we have several years of population data

(a maternity cave in Arkansas) was added to the annual counts. However, population trends of all individual colonies at essential caves are not well explained by available monitoring data due to bat movement among caves, likely including sites that are not known, and due to the difficulty in monitoring bats at certain caves. Recent monitoring at maternity caves during the 2010 summer indicates that colony sizes are down at several sites.

Status and Distribution

Gray bat: The gray bat occurs in limestone karst areas in the Southeastern United States. Populations are known from Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee. The species has also been reported to exist in northwestern Florida, western Georgia, southeastern Kansas, southern Indiana, southern and southwestern Illinois, northeastern Oklahoma, northeastern Mississippi, and western Virginia (USFWS 1982). At the time of its listing, the species' total population size was estimated at 1.6 million individuals. Recent estimates indicate that the range-wide estimate has increased to approximately 3.4 million individuals (USFWS 2009b).

Recovery goals: The Recovery Plan (USFWS 1982) lists the following criteria for consideration when deciding whether to propose downlisting of Gray bats to threatened status:

Documentation of permanent protection of 90% of Priority 1 hibernacula.

With the exception of Marvel Cave in Missouri, all Priority 1 hibernacula and Priority 1 maternity sites have been protected through acquisition, gates, fences, or signage (Service 2009b). Other than Marvel Cave, this reclassification criterion has been met. Conservation measures undertaken at Priority 1 hibernacula and maternity sites are excellent examples of partnerships developed between the Service and other Federal, State, and private entities to contribute to the recovery of gray bat. Four National Wildlife Refuges (NWR) have been established in Alabama that, in part, provide protection for some of the largest populations of gray bat in the country: Fern Cave NWR, Sauta Cave NWR, Key Cave NWR, and the Wheeler NWR which includes Cave Springs Cave. Other gray bat sites protected on Federal land include Bonanza Cave and Blanchard Springs Caverns in Arkansas managed by the U.S. Forest Service, and Cave Mountain Cave in Arkansas managed by the National Park Service. An excellent partnership developed between a private land owner and several entities at two of the largest gray bat sites in Kentucky (i.e., Coach and Jesse James Cave) has contributed to the conservation of the gray bat in Kentucky (Traci Hemberger, pers. comm. 21 Sep. 2009). With financial support of the U.S. Department of the Army's Legacy funds, over 40 volunteers, including cavers, and representatives of the Coach and James Mapping Group, the American Cave Conservation Association, the Kentucky Department of Fish and Wildlife Resources, and the Service participated in an effort to repair damaged and decayed wooden structures in Jesse James Cave (Martin 2007). In Tennessee, a collaborative effort involving the Tennessee Wildlife Resources Agency, The Nature Conservancy, Bat Conservation International, the American Cave Conservation Association, and the Service were successful in acquiring Pearson's Cave, a Priority 1 gray bat hibernaculum (Martin 2007).

Despite these efforts, WNS continues to threaten the species' long-term recovery. In May of 2010, 5 gray bats from Round Spring Cave in Shannon Co., MO tested positive for *Geomyces destructans*. This was the first record of *Geomyces destructans* documented for gray bat; the official designation of the cave where *Geomyces destructans* was documented is "presumptive positive" because histological exams for full blown expression of WNS in the gray bat samples collected were negative. Because an estimated 95% of the species' range-wide population occurs in only nine caves, and the fact that *Geomyces destructans* has already been documented in one cave in MO, the risk to gray bats is extremely high and the species could be threatened with extinction.

Documentation of stable or increasing populations at 75% of Priority 1 maternity caves for 5 years.

This criterion has not been met. The spread of WNS continues to threaten the species' long term recovery (USFWS 2009b). Of the 29 Priority 1 maternity sites listed in the 1982 Gray Bat Recovery Plan, an analysis of data received from state personnel throughout the range of the species and reports by Martin (2007), Sasse et al. (2007), and Elliott (2008) reveal that populations at 13 sites (45%) have been stable or increasing (USFWS 2009b).

The gray bat may be removed from the List of Endangered and Threatened Wildlife (50 CFR 17.11) when the reclassification criteria and the following delisting criteria have been met:

Documentation of permanent protection of 25% of Priority 2 caves in each state.

Using the criterion as defined, it has not been met because no Priority 2 caves in Virginia have been permanently protected. Analyses provided by Martin (2007), Sasse et al. (2007), Elliott (2008) and data provided by various state personnel within the range of gray bat were used to assess the protection and population status of gray bat Priority 2 caves listed in Table 6 of the 1982 Gray Bat Recovery Plan (USFWS 2009b). Based on available information however, approximately 98 of the 135 (73%) Priority 2 caves are protected with gates, fences, or signage (USFWS 2009b). There are numerous examples of partnerships that have developed that provide conservation benefits to Priority 2 gray bat sites. In Missouri, collaborative efforts involving the installation of proper gates at the Missouri Department of Conservation's Mary Lawson Cave and the Missouri Department of Natural Resources' River Cave in HaHa Tonka State Park have contributed to a rebounding of gray bat numbers at these sites.

Documentation of stable or increasing populations of 25% of Priority 2 caves in each state for 5 years.

Opinions differ among gray bat researchers whether this criterion has been met. The spread of WNS continues to threaten the species' long term recovery. Some gray bat experts (e.g. Sasse et al. 2007) believe that 5 years is an inadequate time period to assess stable or increasing trends for this species. Nonetheless, populations of many gray bat Priority 2 caves have been monitored for more than 5 years and roughly 33% of Priority 2 caves across the species' range have stable or increasing populations.

Indiana bat: The Indiana bat was listed as an endangered species on March 11, 1967 (Federal Register 32[48]:4001) under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa[c]). The Endangered Species Act of 1973 extended full protection to the species. Thirteen winter hibernacula (11 caves and two mines) in six states were designated as Critical Habitat for the Indiana bat in 1976 (Federal Register, Volume 41, No. 187).

Recovery goals: The draft Revised Recovery Plan (USFWS, 2007) lists the following criteria for consideration when deciding whether to propose downlisting of Indiana bats to threatened status:

- Permanent protection of 80 percent of Priority 1 hibernacula
- A minimum overall population number equal to the 2005 estimate (457,000)
- Documentation of a positive population growth rate over five sequential survey periods.

The Indiana bat will be considered for delisting when the Reclassification Criteria have been met and the following additional criteria have been achieved:

- Permanent protection of 50 percent of Priority 2 hibernacula
- A minimum overall population number equal to the 2005 estimate
- Continued documentation of a positive population growth rate over an additional five sequential survey periods.

Because the vast majority of Indiana bats form dense aggregations or “clusters” on the ceilings of a relatively small number of hibernacula (i.e., caves and mines) each winter, conducting standardized surveys of the hibernating bats is the most feasible and efficient means of estimating and tracking population and distribution trends across the species’ range. Collectively, winter hibernacula survey data provide the Service with the best available representation of the overall population status and relative distribution.

For several reasons, interpretation of the census data must be made with some caution. First, winter survey data has traditionally been subdivided by state due to the nature of the data collection. As described below, each state does not represent a discrete population center. Nevertheless, the range-wide population status of the Indiana bat has been organized by state thus far. Second, available information specific to the “reproductive unit” (i.e., maternity colony) of the Indiana bat is limited. While winter distribution of the Indiana bat is well documented, relatively little is known as to the size, location and extant number of maternity colonies for the Indiana bat. It is estimated that the locations of approximately 90 percent of the estimated maternity colonies remain unknown.

Additionally, the relationship between wintering populations and summering populations is not clearly understood. For example, while it is known that individuals of a particular maternity colony come from one to many different hibernacula, the source (hibernacula) of most, if any, of the individuals in a maternity colony is not known. Indiana bats have been documented to travel up to 300 miles from their hibernaculum to their maternity areas (Gardner and Cook 2002). As

such, the origin of the bats (hibernacula) that comprise the maternity activity in the action area is unknown.

Rangewide Winter Hibernacula Surveys

The data regarding Indiana bat abundance prior to Federal listing are limited, but the information suggests that they were once far more abundant than they were in the 1960s. Tuttle and colleagues, for example, believe the overall abundance of Indiana bats likely rivaled that of the now extinct passenger pigeon (Tuttle et al. 2004). The basis for Tuttle's and others estimates of millions of Indiana bats prior to European settlement is primarily based on historic accounts (e.g., Blatchley 1897, Silliman et al. 1851), extensive staining left on the ceilings of several historic hibernacula (Tuttle 1997, Tuttle 1999), and other paleontological evidence (Munson and Keith 1984, Toomey et al. 2002). For example, an analysis of bone deposits in Bat Cave, KY revealed that an estimated 300,000 Indiana bats died during a single flood event at some point in history (Hall 1962). Although we are never likely to know the true historical abundance of Indiana bats, it seems clear from the evidence above that Indiana bats were much more abundant than observed in 1960.

When the Indiana bat was originally listed as endangered in 1967, there were approximately 883,300 bats and most of these hibernated in a small number of hibernacula (Clawson 2002). Since it was listed, the species' population numbers have apparently continued to decline through approximately 2001. Although some winter bat surveys began as early as the late 1950s, systematic surveys were not conducted across the range until the mid 1980s when there were an estimated 678,750 Indiana bats (Clawson 2002). Since being listed, large population declines have been observed, especially at hibernacula in Kentucky and Missouri. Caves in Kentucky suffered dramatic losses because of changes in microclimate due to poor cave gate design in two of the three most important hibernacula (Humphrey 1978), and Indiana bat numbers in Kentucky hibernacula had continued to decline until 2005 when an increase was first observed (King, personal communication 2007). Despite recovery efforts, Indiana bats in Missouri caves have continuously declined with a loss of more than 80 percent of the previous population size (Clawson 2002). From the 1960s/70s to the most recent population survey in 2009, the rangewide population of the Indiana bat has declined from approximately 883,300 Indiana bats for 1960/1970 to 390,000 in 2009, or approximately 56 percent. The 40-year population trend from 1960 – 2000 of the Indiana bat has shown a steady decline.

The 2005 Indiana bat rangewide population estimate totaled approximately 425,430 bats; a 17% increase over the 2003 estimate of 364,030 bats (USFWS, unpublished data, 2010). In 2005, about 60% of the estimated 425,430 Indiana bats were hibernating in nine Priority 1 hibernacula in four states: 4 hibernacula in Indiana, 3 in Missouri, 2 in Kentucky and 1 in Illinois (USFWS, unpublished data, 2005). Priority 2 hibernacula are known from the aforementioned states, in addition to Arkansas, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. Priority 3 hibernacula have been reported in 21 states, including all of the aforementioned states.

Although a notable increase (10.8%) over the previous biennial rangewide population estimate first occurred in 2003, these results may not be statistically or biologically significant, and no determinations can be made with confidence from such a limited survey period. Small fluctuations from year-to-year may be attributed to such factors as weather affecting the success

of reproduction for a given year (Humphrey and Cope 1977); and therefore, it is not appropriate to extrapolate long-term trends from changes between individual survey periods. Nonetheless, in 2005 there was almost a 17% increase over the 2003 estimate and another 10% increase between 2005 and 2007. Unfortunately, the rangewide population experienced an apparent 16.6% decline in 2009 (USFWS, unpublished data, 2010). This was the first observed decline in the range-wide population since 2001. The observed decline between 2007 and 2009 was partly a result of WNS-related mortality in the Northeast, but large, as of yet unexplained, population declines also occurred at some key hibernacula in Indiana and Kentucky as well. Nearly half of the 2009 range-wide population hibernated in Indiana caves.

Some investigators believe that warmer winter temperatures may have resulted in less conducive microhabitat conditions (warmer temperatures) at hibernacula, particularly in the southern part of the species range (Rick Clawson, personal communication, 2007), but this has yet to be rigorously investigated. Other declines have occurred as winter hibernacula have flooded, hibernacula ceilings have collapsed, or cold temperatures kill bats through hypothermia. Exclusion of bats from hibernacula through blocking of entrances, installation of gates that do not allow for bat ingress and egress, disruption of cave air flow, and human disturbance during hibernation have been documented causes of Indiana bat declines. Because many known threats are associated with hibernation, protection of hibernacula still remains a top management and recovery priority. Although some hibernacula have been restored in order to support future wintering populations, Indiana bats have not returned to some of these hibernacula as anticipated while they have quickly recolonized others.

Despite the protection of most major hibernacula, population declines generally have continued until the apparent increases in 2003 - 2007. Continued population declines of Indiana bats, in spite of efforts to protect hibernacula, initially led some scientists to the conclusion that additional information on summer habitat is needed (Rommé et al. 1995), but others contended that the primary cause of continued declines stemmed from suboptimal microclimates within traditional hibernacula and/or high human disturbance levels (Tuttle and Kennedy 2002). In addition to increased focus on these issues, attention has also been directed to pesticide contamination. Insecticides have been known or suspected as the cause of a number of bat die-offs in North America, including endangered gray bats (*Myotis grisescens*) in Missouri (Clark et al. 1978). The insect diet and longevity of bats also exposes them to persistent organochlorine chemicals which may bioaccumulate in bat tissue and cause sub-lethal effects such as impaired reproduction.

Maternity Colonies

To date, most records of reproductively active female and juvenile Indiana bats have occurred in glaciated portions of the upper Midwest including southern Iowa, northern Missouri, most of Illinois, most of Indiana, southern Michigan, and western Ohio (Gardner and Cook, 2002; USFWS unpubl. data, 2010). The first maternity colony was found in east-central Indiana in 1971 and most subsequent surveys and studies of Indiana bat maternity habitat have been conducted in the upper Midwest (Cope et al. 1977, Clawson 2002). Unglaciated portions of the Midwest (southern Missouri, parts of southern Illinois, and south-central Indiana), Kentucky, and most of the eastern and southern portions of the species' range appear to have fewer maternity colonies per unit area of forest than does the upper Midwest. However, increased summer

survey efforts are needed elsewhere in the range, however, before final conclusions may be reached regarding relative abundance across the species' summer range.

In recent years, multiple maternity colonies have been discovered in the Champlain Valley and lower elevations of adjacent hills between Burlington, Vermont, and Ticonderoga, New York (A. Hicks, pers. comm., September 2005). In contrast, the first maternity roosts in "the South" were found in very different types of habitat, in areas of extensive mature forest in the southern Appalachian Mountains of North Carolina and Tennessee. In further contrast, these colonies were found roosting in eastern hemlock (*Tsuga canadensis*) and pines (*Pinus* spp.), rather than deciduous trees (Harvey 2002).

Based on published literature and correspondence with Service and state biologists throughout the range of the Indiana bat, maternity activity has been documented at approximately 269 locations throughout the species' range (USFWS 2007, Table 5). The majority of confirmed maternity areas are in the "core" of the range, in the glaciated Midwest in pockets of remaining forested habitat within a predominantly agricultural landscape and in the Northeast (i.e., NY and VT). Because the Indiana bat is philopatric (i.e., loyal to its traditional summering area), there is currently no evidence to suggest that all maternity colonies are located in optimal foraging and roosting habitat. A possibility that may have contributed to the species' decline is that many existing maternity colonies are senescent (i.e., deaths outnumber births) or are population sinks. This could be caused by pups being produced but not surviving their first hibernation period; or maternity areas are no longer providing a sufficient supply of suitable prey, resulting in an increase in the age of first reproduction and increasing fecundity schedules. Proof of at least several years of successful reproduction and recruitment would be needed to verify long-term survival of the Indiana bat in these highly altered and fragmented landscapes. Although data at a few maternity sites indicate that reproduction is occurring (exit counts nearly double a month after birth), long-term monitoring of maternity sites is limited. Long-term monitoring has been conducted at a maternity colony located near the Indianapolis Airport (3D/I 1995, 3D/I 1997). This colony continues to persist, and shows evidence of reproduction, although additional monitoring is needed to make a determination regarding whether the colony is stable, increasing, or decreasing at this site.

Monitoring data, including extensive exit counts to estimate maternity colony population size and structure over more than one-year, is available for only a few of the approximately 269 maternity colonies discovered (Humphrey et al. 1977; Garner and Gardner 1992; Callahan 1993; Gardner et al. 1991b; Kurta et al. 1993). Additionally, because the vast majority of the Indiana bat maternity colonies have not been discovered, let alone studied, what little demographic data that is available, represent a fraction of the range-wide maternity activity.

Because so little is known regarding the population size and structure of maternity colonies, the Service used the same assumption as Whitaker and Brack (2002) to determine the average maternity colony size to give an approximation of the number of potential maternity colonies across the range of the Indiana bat. The Service recognizes that maternity colonies are not static in size, and the numbers of individuals that comprise a maternity colony likely vary widely as a colony adjusts to current conditions, including the availability and quality of roosting and foraging habitat, and variable climatic conditions. Therefore, these figures should not be used to make extrapolations regarding the densities or distribution of maternity colonies present within

portions of the species range; however, these figures do serve to provide a rough estimation regarding the number of maternity colonies that might be present across the landscape.

Recognizing the inherent deficiency in such an assumption, these calculations illustrate that the vast majority of maternity colonies for the Indiana bat have not been documented. The location of most maternity colonies may always remain unknown because of the difficulty in detecting maternity activity for the Indiana bat. Some unknown proportion of these colonies may be at risk when land use practices and changes, such as timber harvesting and development, are carried out. Therefore, another likely cause for the decline of this species is that some maternity colonies are being reduced in numbers, and in some cases extirpated, prior to their discovery.

The Indiana bat is currently affected by WNS. Accurate estimates of the number of Indiana bats that have died due to WNS are not available, but New York Indiana bat populations alone have declined by approximately 61% due to WNS since 2006 (Armstrong 2010). The largest populations of Indiana bats (in Indiana, Kentucky, and Illinois) are expected to be affected by WNS within the next year or two.

Virginia big-eared bat: The Virginia big-eared bat was listed as endangered under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) in 1979 due to their small population size, limited distribution, and vulnerability to human disturbance. Since the time of listing, recovery efforts have been focused on purchasing important Virginia big-eared bat habitats, and working with private landowners to implement protective measures such as gating cave entrances and restricting access to caves during times that Virginia big-eared bats are present. These measures have been extremely successful, and numbers of hibernating Virginia big-eared bats have increased approximately 450% since 1984, when the recovery plan was finalized (USFWS 2008a, USFWS 1984).

Recovery goals: The Recovery Plan (USFWS 1984) lists four criteria for consideration when deciding whether to propose downlisting of Virginia big-eared bats to threatened status:

- Documentation of long-term protection of 95% of all known active colony sites.
- Documentation of stable or increasing populations at 95% of the known active maternity sites and hibernacula for a period of five years.
- Foraging habitat for both subspecies [includes Ozark big-eared bat] must be identified, and restored as much as possible. However, a given amount of foraging habitat cannot be required in the objective at this time due to lack of information on colony needs.
- Finally, a periodic monitoring program must be established to ensure a continued awareness of the status of these animals.

The Recovery Plan also concluded that “It seems unlikely that the Virginia big-eared bat will recover to a point where it can be removed from the threatened list. However, this matter should be reconsidered at the time its status is reduced from endangered to threatened.”

Currently, down-listing criteria 1-3 have not been met. Although significant progress has been made to protect major hibernacula and maternity caves from disturbance through gates, fences, or signed closures, only four of the seven major hibernacula throughout the species' range have documented long-term protection. Hellhole, the largest hibernaculum is on private-lands. As a result, approximately 36% of the hibernating population has long-term protection. Only seven of the 13 major maternity colonies have documented long-term protection. The protected caves comprise 59% of the total population of Virginia big-eared bats. Although there have been fluctuations and decreases in populations within individual caves, the range-wide population within both hibernacula and maternity colonies has increased since the time of listing. While the documented range of the species has expanded, the major population concentrations remain within the range of the species that was known at the time of listing. A number of additional caves have been discovered, including significant hibernacula within North Carolina. An effective periodic monitoring program has been implemented range-wide that provides information on population trends and continued awareness of the status of the species.

Continuing threats include lack of long-term protection, loss of cave habitat from quarries and mining activities, the presence of oil and brine separation pits, and loss of foraging habitat through development and road construction. In addition, the construction of wind farm projects within close proximity of Virginia big-eared bat caves, coupled with the lack of consistent and effective regulatory oversight of these projects, represents a significant and newly emerging threat. Although predation and vandalism at caves seems uncommon, one predator or vandalism event could have significant adverse impacts on a colony. This threat is a potential problem at all Virginia big-eared bat caves. Natural changes in caves, such as breakdown, sinkholes, landslides, and flooding, can also alter cave conditions so that they are no longer suitable to support the species or create safety hazards that affect the ability of biologists to monitor the species.

To date, no Virginia big-eared bats have shown visible signs of WNS. However, a number of caves known to support Virginia big-eared bats have had other bat species that were confirmed to have WNS. Hellhole Cave, which contains the largest hibernating population of Virginia big-eared bats in the world, was confirmed positive for WNS in January 2010. In addition to Virginia big-eared bats, the cave contains significant numbers of Indiana bats and little brown bats. In 2010, the cave contained 18,557 Indiana bats, up approximately 5,700 from the previous survey in 2007. Approximately 1.6% of the Indiana bats showed signs of WNS. There were 38,155 little brown bats in the surveyed areas of the cave in 2010. This is an approximately 50% decline from the 2007 survey (WVDNR, 2010). The area of the cave where Virginia big-eared bats roost is known to be drier than other areas of the cave. It has been suggested that bats roosting in drier caves/areas may be less susceptible to the effects of WNS. However, some little brown bats in rooms containing Virginia big-eared bats did exhibit signs of WNS in 2010. In 2009, a little brown bat was observed in Cliff Cave, a site that supports 125 hibernating Virginia big-eared bats. Due to hazardous access conditions, this site was not resurveyed in 2010. WNS has also been observed in little brown bats from Cave Mountain and Sinnitt/Thorn Cave which are designated critical habitat for Virginia big-eared bats as maternity sites.

In summer 2010, the Service outlined a number of factors that potentially make Virginia big-eared bats extremely susceptible to the risk of extinction and/or local extirpation from WNS. These include:

- the extremely limited number of caves known to support the subspecies (only eight hibernacula range-wide that support groups of more than 100 individuals);
- the concentration of the largest sub-population (containing 60-77% of the range-wide population) within a restricted geographic range (a 30 x 36 mile area);
- the documented emergence of WNS within this area including within the fourth largest Virginia big-eared bat hibernaculum for that sub-population and also in another cave that is one of the five caves designated as critical habitat;
- the proximity of the remaining sub-populations to other known WNS-affected caves (30-60 miles to western Virginia/North Carolina, 60 miles to southern West Virginia, and 150 miles to the Kentucky populations);
- the limited number of caves that support Virginia big-eared bats in the three smaller sub-populations (The States of Virginia, Kentucky, and North Carolina each have only one cave that supports groups of more than 100 hibernating individuals);
- the geographic isolation and genetic distinction of the four sub-populations, making it unlikely that the bats could naturally re-colonize areas historically occupied by another sub-population once the effects of WNS are ameliorated.

It was/is anticipated that WNS could occur throughout the entire range of the Virginia big-eared bat within the next 1-2 years.

Ozark big-eared bat: The historic range of the Ozark big-eared bat included eastern Oklahoma, northwestern and north central Arkansas, and southwestern Missouri (USFWS 1995). The species currently occurs in the Service's Southeast Region; it has been recorded from 21 caves in Arkansas, four of which are considered to be essential to the continued existence of the species. It may also occur in 12 additional caves in the Service's Southeast Region (USFWS 1995). Range-wide estimates of numbers for the species range from 1,800 to 2,000 individuals (Richard Stark, personal communication).

The original recovery plan was approved on May 8, 1984 (USFWS 1984). The recovery plan included both federally-listed subspecies of *Corynorhinus townsendii*, the Ozark big-eared bat (*C. townsendii ingens*) and the Virginia big-eared bat (*C. townsendii virginianus*). The original recovery plan was revised, Ozark Big-Eared Bat (*Plecotus townsendii ingens*) Revised Recovery Plan, March 28, 1995, to specifically address and update biological information, management techniques, and identify new recovery tasks for the Ozark big-eared bat.

Recovery goals: The Revised Recovery Plan (USFWS, 1995) lists the following criteria for consideration when deciding whether to propose downlisting of Ozark big-eared bats to threatened status:

- Stable or increasing populations at all essential caves (*i.e.*, caves used as a maternity site and/or hibernacula that are considered essential to the continuing existence of the Ozark big-eared bat).

- The Ozark Plateau National Wildlife Refuge is operational with authority, funds, and manpower to a) enhance management of Refuge caves and properties, b) construct cave gates and fences where needed, c) monitor populations, d) deter human disturbance through law enforcement, e) implement cave management agreements with private landowners, and f) coordinate recovery efforts on an ecosystem basis across State and Fish and Wildlife Service regional boundaries.
- Protect all limited-use sites (*i.e.*, sites used by single individuals and small groups).
- Reestablish stable or increasing population's at all available historic caves in Oklahoma, Arkansas, and Missouri.

Although mortality attributable to WNS has not occurred within the range of the Ozark big-eared bat, the fungus associated with WNS recently was documented on a single cave myotis (*Myotis velifer*) collected alive from a cave on May 3, 2010, in northwestern Oklahoma. The fungus also was found on gray bats in Missouri during the spring of 2010, a species that co-occurs in caves with the Ozark big-eared bat. If WNS moves into the range of the Ozark big-eared bat (and if Ozark big-eared bats prove to be susceptible to the disease), the potential impact would be severe due to the high mortality rate of affected bats in the northeastern and eastern United States, and the small population size (1,800) and limited distribution (eight counties in Oklahoma and Arkansas) of the Ozark big-eared bat.

Analysis of the Species/Critical Habitat Likely to be Affected

With the exception of Puerto Rico and the U.S. Virgin Islands, the activities addressed in this biological opinion could be conducted anywhere within the ranges of the Ozark big-eared bat, Virginia big-eared bat, Indiana bat, or gray bat in the Service's Southeast Region (Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas), including designated critical habitat for the Indiana bat in Kentucky and Tennessee. The ranges of many other federally-listed species overlap the ranges of the four bat species and other designated critical habitat areas occur in the Southeast Region; however, the proposed action is the issuance of permits to conduct specific recovery and scientific collection actions for the four bat species. As a result, it is unlikely that adverse effects will occur to other federally listed species. If adverse effects to other federally listed species could occur, those adverse effects would have to be authorized by a separate Section 10(a)(1)(A) permit, by an Incidental Take Statement associated with a separate biological opinion (if a federal action), or by a Section 10(a)(1)(B) incidental take permit depending on the specific nature of the action.

ENVIRONMENTAL BASELINE

Status of the Species within the Action Area

Gray bat: Within the action area, the gray bat occurs in the cave/karst regions of northern Arkansas; Kentucky and Tennessee; northwestern Georgia; northern and central Alabama; and northwestern Florida. There are three major hibernacula in Tennessee, two in Kentucky, one in

Alabama, and one in Arkansas. Summer roosts, including maternity and bachelor colonies, also exist in the action area. State-by-state population estimates within the action area are not available, but range-wide, numbers of gray bats, based on biennial counts, have increased from 1,575,000 in 1982 to 3,400,000 in 2004 (USFWS 2009b).

Indiana bat: The Indiana bat occurs over a wide range in the action area. Hibernacula and/or summer roost sites are known in Arkansas, Kentucky, Tennessee, North Carolina, Alabama, and Florida. Based on biennial counts, range-wide estimates of Indiana bats indicate that the species declined from 560,975 in 1981 to 328,715 in 2001. Numbers increased to 468,260 in 2007, but the latest count in 2009 produced only 388,247 individuals (USFWS 2007).

Virginia big-eared bat: Within the action area, the Virginia big-eared bat occurs only in eastern Kentucky and western North Carolina. In Kentucky, one cave is known to support a hibernating colony of approximately 3,120 individuals, and there are five substantial summer sites known in Kentucky (Service 2008a). These populations seem relatively stable; however, they represent only one-quarter to one-third of the winter population in Kentucky, so there are likely other as-yet-unidentified maternity sites in the area. Individuals and small groups of individual Virginia big-eared bats are also known to utilize rock shelters in sandstone cliffs as maternity or summer roosts. Small hibernating colonies of approximately 400 Virginia big-eared bats have been documented in three caves in western North Carolina since the mid 1980's (USFWS 2008a).

Ozark big-eared bat: The Ozark big-eared bat is known to occur in the action area only in northwestern and north-central Arkansas. Four caves in the action area are considered to be essential to the species' survival - two hibernacula, a maternity cave, and a possible alternate maternity cave (USFWS 1995). The population estimate of the species in Arkansas is approximately 600 individuals.

Factors Affecting Species Environment within the Action Area

A variety of past and on-going activities have had short- and/or long-term adverse effects on the four bat species addressed in this biological opinion. Mining for coal and other minerals has resulted in degradation of water quality and removal of forest habitat that provides forage (e.g., insects), foraging areas, travel corridors between roosting areas and foraging areas, and roosting/maternity colony habitat. Logging, whether associated with mining or not, results in removal of forest habitats that could be used for foraging. Agricultural activities remove forest habitat and, if not conducted properly, cause sedimentation of streams. Development for residential, commercial, or highway purposes can result in water quality degradation, channelization of streams, and removal of forest habitat. Runoff from developed areas can introduce pollutants into streams and can alter cave recharge areas. Construction of wind farms has been shown to adversely affect bats; significant mortality of bats has resulted from collisions or from barotrauma (i.e., air pressure changes caused by the turbines) at operational wind farms.

The Service and its other federal, state, non-governmental, and other partners have undertaken a variety of recovery actions for the four bat species. In particular, gating of major known hibernacula and maternity caves has had long-term beneficial effects on the four bat species by preventing human entrance to caves during times when the bats are particularly sensitive to disturbance. Habitat restoration and protection efforts by the Service, state wildlife agencies, and

others have helped improve or maintain habitat areas for these four bat species. Additional efforts by these agencies and groups are likely to continue into the future.

White-nose syndrome is a new, significant threat and a key factor relative to the recovery potential of endangered bat species. WNS has resulted in significant declines of bat populations (including the Indiana bat) in the northeastern U.S. and may cause similar declines in bat populations in other parts of the country, including the Southeast Region. Although the Service recently initiated an effort to evaluate the potential for down-listing the gray bat, this evaluation was discontinued because of the potential for WNS to have catastrophic adverse effects on the species.

WNS-affected bats exiting caves prematurely in the northeast U.S. tended to experience lower ambient temperatures than are typical in the southeast U.S. It is currently suggested that most of these individuals starved due to increased arousal throughout hibernation. Normally, bats arouse from torpor 1-2 times each month during the winter. WNS affected bats arouse significantly more often as they are trying to clean the fungus (*G. destructans*) from their skin and fur. It is currently believed that the fungus irritates the bats to the point of arousal, because it invades the dermal layers and presumably causes itching. At some point, WNS infected bats appear to recognize they have burned their fat reserves and are observed flying out of the hibernacula in search of food and water. Insect availability is low or non-existent in the winter months in the northeastern U.S. but, in the best scenario, would be considered unreliable in the southeast region. It is possible that WNS-affected bats in similar situations in the Southeast Region may have greater survival due to higher ambient air temperatures resulting in later ingress into the hibernacula and earlier egress out of the hibernacula (e.g., bats in more southern climates may not require the same fat reserves as bats in northern climates). Although unreliable, the greater availability of insects in southern climates may also provide some relief to those individuals leaving the hibernaculum early in search of food and water.

EFFECTS OF THE ACTION

Factors to be considered

Activities conducted in association with ongoing bat research, surveys, monitoring, and the activities associated with the Service's response to WNS could result in adverse effects to listed bats. These activities include the following: (1) non-invasive activities not involving handling of bats, (2) minimally invasive activities that involve handling of bats with low potential for physical injury, and (3) invasive activities that will cause or have the potential to cause direct physical injury or mortality to listed bats and/or an extended period of harassment. The nature of the effect and its proximity, distribution, timing, duration, frequency, intensity, and severity to bats are important factors to consider in evaluating each type of activity.

Proximity of the Action: With the exception of Puerto Rico and the U.S. Virgin Islands, the activities addressed in this biological opinion could be conducted anywhere within the ranges of the gray bat, Indiana bat, Ozark big-eared bat, and Virginia big-eared bat in the Service's Southeast Region (Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas) including designated critical habitat for the Indiana bat in Kentucky and Tennessee.

Distribution: Adverse effects to the gray bat, Indiana bat, Virginia big-eared bat, and Ozark big-eared bat from the proposed action may occur anywhere within their ranges in the Service's Southeast Region (Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Arkansas).

Timing: Adverse effects to the Indiana bat, gray bat, Virginia and Ozark big-eared bats from the proposed action may occur at anytime of the year and within all sensitive periods of the four bat species' life cycles.

Nature of the Effect:

- (1) Non-invasive activities that do not involve handling of bats include surveys conducted with visual counting and electronic monitoring techniques. Monitoring via electronic equipment in caves is used for continual monitoring of roosting bat populations with minimal disturbance. These activities have the potential to affect feeding, sheltering, and reproductive behavior resulting in harassment to the bats.
- (2) Minimally invasive activities that involve handling of bats but have a low potential for physical damage to bats are conducted by experienced biologists who are recognized as bat handlers and who have demonstrated an ability to minimize potential harm to bats. These activities include hair clipping, banding, harp trapping, mist netting, collection of fecal material, attachment of light tags, attachment of radio transmitters, and collection of information (e.g., species, sex, band data, wing damage, weight, forearm length, and reproductive condition). These activities have the potential to affect the bats' feeding, sheltering, and reproductive behavior resulting in harassment to the bats, and, since the bats are being handled, the bats may be harmed although that harm has been minimized through the use of experienced biologists.
- (3) Invasive activities which will cause or have the potential to cause direct physical damage to bats are also conducted by experienced biologists that are recognized as bat handlers and have demonstrated the ability to minimize potential harm to bats. These activities include wing punches and hair removal. In addition to direct physical harm to bats, stress and subsequent adverse effects upon feeding, resting, or reproductive behavior could result from these activities resulting in additional harassment.
- (4) As indicated previously, some activities may be required as part of planned surveillance, monitoring, and response measures for WNS, which may cause mortality. These activities include euthanizing an individual bat per roost that exhibits WNS symptoms so they can be tested for WNS. These bats would be subjected to short-term harassment followed by purposeful mortality.

Duration: The effects of the majority of proposed activities covered through the issuance of this programmatic biological opinion are considered single, short-term events or pulse effects (e.g., those non-invasive activities occurring at sites where bats are encountered). Although short-term effects occur at sites where bats are encountered, longer-term effects or press effects from invasive activities may occur as bats disperse across the landscape after the completion of sampling events. For instance, wing punches are not typically believed to have long-term

negative effects on affected bats; however, it is possible that listed bats with wing punches may develop secondary infections, may suffer temporary foraging or maternity care inefficiencies, or, at worst, delayed mortality.

Disturbance Frequency: The mean number of disturbance events is expected to vary depending upon the specific objectives of the activity proposed. Activities taking place within winter hibernacula and/or summer roosts may have a higher number of disturbance events than activities accomplished randomly across the summer landscape. The number of disturbances at these winter and summer roosts will largely be determined by the site specific conditions (e.g., species present, ease of access, WNS presence, etc.). However, the work conducted by permits issued under this biological opinion must be related to recovery; therefore, the frequency of disturbance from the proposed activities is always anticipated to be less than the recovery rates for the four listed species.

Disturbance Intensity: None of the take associated with the recovery-related activities covered under this biological opinion is expected to be at a scale measurable at the population level after the disturbance. More specifically, the only potential loss of an individual from a population either in their winter hibernaculum or summer roost is if: (1) disturbances to maternity roosts cause non-volant pups to be dropped, injured, and/or killed; (2) mist net and harp trap surveys create an opportunity for harm or mortality to occur through injury; and (3) selected individuals are moribund due to WNS or showing advanced symptoms of WNS and subsequently euthanized. However, one individual of any of the four listed bat species would only be removed from the population under specific conditions as outlined above (See Page 6, Number 11. Selective euthanasia of listed bats for WNS testing). If a single listed bat was removed from a winter hibernaculum or summer population, the disturbance intensity and loss of one individual is expected to be insignificant to the population from which it was removed.

Disturbance Severity: None of the recovery-related activities covered under this biological opinion are expected to be at a scale measurable at the affected population or species level after the disturbance. More specifically, the most severe disturbance would result in the potential loss of one individual from a population either in their winter hibernaculum or summer roost if the individual is moribund due to WNS or showing advanced symptoms of WNS. However, one individual of any of the four listed bat species would only be removed from the population under specific conditions as outlined above (See Page 6, Number 11. Selective euthanasia of listed bats for WNS testing). If a single listed bat was removed from a winter hibernaculum or summer population, the disturbance severity is not expected to make the population from which it was removed or the species overall more susceptible to the effects of other actions. Furthermore, we expect the overall impact of a permitted recovery activity would always be positive. Otherwise, the recovery permit would be denied.

Analyses for Effects of the Action

Beneficial Effects: While these permitted recovery activities are expected to always have a beneficial impact on recovery of the four listed bat species, there are no wholly beneficial effects

tied to the proposed action. It is expected that each permit will allow activities that may have adverse effects on the four listed bats species.

Direct Effects: The proposed activities will have a variety of direct adverse effects on the four bat species, and these effects will be influenced by the severity, duration, and other factors related to the proposed action.

- Entering summer or winter roosts may cause unnatural arousal of bats, which may have adverse effects ranging from minor harassment to short-term harm. For example, we would expect greater arousal rates to occur during counts for population or WNS monitoring than for installation of detection equipment, because equipment installation would typically occur at roost entrances instead of roosting sites (i.e., a greater distance from bats) and result in less time within the roost (i.e., a lower time of exposure to disturbances). Similarly, disturbances of roosts will cause bats to unnaturally expend energy and disturbances of maternity roosts may cause disruptions to feeding of pups or may cause non-volant pups to be dropped, injured, and/or killed. However, this is only likely to happen where unknown maternity populations exist, because such activities are typically not conducted in known maternity colonies to avoid just these types of effects.
- The salvage of dead bats and the receipt and handling of dead bats and genetic material will have no direct effects, because there is no take associated with individuals that are already dead (assuming the death was not caused by any permitted or illegal activity) and, for genetic materials obtained through permitted activities, any take associated with these activities will have already occurred as part of the permitted activities.
- Mist net and harp trap surveys during the non-hibernation season will have direct effects on captured bats by altering their foraging behavior, harassing bats while being handled, and creating an opportunity for harm or mortality to occur. In addition, maternal behavior may be altered by temporarily delaying the return of lactating females to nursing non-volant pups.
- Collecting data from individual bats, hair clipping, banding, attachment of radio transmitters and light tags, and collection of wing punches will have direct effects on handled bats, because the bats will be harassed or harmed during handling and the collection of data. For hair clipping, attachment of radio transmitters and light tags, and collection of wing punches, direct harm will occur due to the purposeful removal of tissues from the bats. Collection of wing punches is expected to be more harmful than these other activities; collection of external data and banding are expected to be the least harmful of these activities.
- Collection and euthanasia of listed bat(s) showing advanced symptoms of WNS will cause short-term harassment and then mortality of a small number of listed bats that are expected to show advanced symptoms of the disease and will not survive the disease currently as no cures for WNS are currently available (See specific conditions defined on Page 6, Number 11. Selective euthanasia of listed bats for WNS testing).

Interrelated and Interdependent Actions: No interrelated or interdependent actions were identified. Each permit application will be evaluated on its merits considering issuance criteria

at 50 CFR 17.22(a)(2) or 17.32(a)(2). Also, each permit that is issued will have independent utility in that each permittee will accomplish specific permitted activities that do not depend on any other similar permit or take authorization that may be issued by the Service's Southeast Region.

Indirect Effects: The frequency of activities that do not involve handling of bats has been an important focus during population surveys at roost sites. Because disturbance of hibernating bats can interrupt torpor with potential subsequent effects upon energy reserves, this activity has been minimized for endangered bat species. Ongoing population surveys for the gray bat, Indiana bat, and Virginia and Ozark big-eared bats are conducted in hibernacula once every two years. Prior to the introduction of WNS, this frequency has been considered a reasonable balance between the need to monitor species' recovery and the need to minimize stress upon bats. Annual surveys of some bat populations are being considered as WNS spreads to the south and west. The potential increase in monitoring due to the presence of WNS will continue to be weighed against the need to minimize disturbance to bats.

The installation and use of remote monitoring equipment may result in disturbance to bats. However, the intensity and frequency of disturbance during installation of equipment is usually minimal. Although extremely rare, the duration of ultrasonic disturbance from some monitoring equipment (e.g., I-buttons for microclimate monitoring) can extend for weeks or months, and bats may alter their roosting locations as a result.

Other indirect effects that may occur are related to latent effects on individuals and populations that may result from proposed activities. For instance, wing punches are not typically believed to have long-term negative effects on affected bats; however, it is possible that listed bats with wing punches may develop secondary infections, may suffer temporary foraging or maternity care inefficiencies, or, at worst, delayed mortality.

Species' Response to a Proposed Action

Numbers of Individuals/Populations in the Action Area Affected: Gray bats are by far the most common of the four species in the southeast region easily eclipsing 1 million individuals. The last estimate for the number of Indiana bats in the southeast region was provided in the 2009 Indiana bat 5-year review (USFWS 2009a) and puts the total at just under 72,000 individuals. Comparatively, the numbers of Virginia and Ozark big-eared bats within the region are much lower at approximately 3,500 and 600 individuals, respectively. It is anticipated that only a small percentage of the total number of individuals and/or populations of the four listed bat species will be affected in the action area from the proposed recovery-related actions. Similarly, it is not expected that the disturbance to these individuals or populations will significantly reduce the four species' numbers of individuals/populations or their recovery rates due to the frequency, duration, and nature of the effects from the proposed action.

Sensitivity to Change: In general, bats are sensitive to disturbances at their summer and/or winter roosts and, as a result, could relocate to other roosts. This is especially true when significant and/or numerous disturbances occur at their winter hibernacula and/or summer roosts. However, such disturbances are tightly controlled in order to minimize their effect.

Resilience: All four bat species exhibit high resiliency rates. Recovery activities have been implemented for these species for many years with no demonstrable negative effects on their populations. We would have expected to see demonstrable population effects on these species by now as a result of ongoing long-term recovery activities if the resiliency of these bat species was low. Therefore, we anticipate that the proposed activities would cause no measureable population decline based on the past resiliency demonstrated by these bat species.

Recovery Rate: All four bat species are expected to recover from the take associated with the proposed activities in a short timeframe. The minor activities that do not involve handling listed bats are expected to have negligible effects, and activities involving handling are expected to result in adverse effects that are more significant. Since little or no mortality of individuals is expected, we believe that populations will be unaffected. In addition, permitted recovery actions are expected to result in a long-term net benefit to the species (by definition).

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation under Section 7 of the Act.

Activities such as logging and development on private lands are ongoing and are reasonably certain to occur in the future in the Southeast Region. These activities affect listed bat species by removing forest habitat that serves as roosting and foraging habitat and travel corridors between caves and foraging areas. It may also result in significant sedimentation of adjacent streams that provide important foraging habitat.

Recreational caving may adversely affect bats through disturbance of roosting or hibernating individuals. Entering a cave that has been infected by *Geomyces destructans*, the fungus believed to be responsible for the death of more than one million bats in the northeast U.S. from WNS, can result in the transmission of this disease to other caves yet to be infected if proper steps (e.g., decontamination of gear and clothing and avoiding the use of potentially infected gear in unaffected caves) are not taken by individuals visiting these sites. Once WNS is transmitted to a new cave, it may spread throughout the bat population present within the new site leading to potential future mortality events. Disturbance of a maternity colony may cause young, non-volant bats to fall from the ceiling and adults may move their young to another cave. These disturbances may also cause bats to awaken and prematurely use some of their stored fat reserves. Multiple disturbances may cause the bats to leave a hibernaculum early in search of food items. Some recreational uses of caves have led to the mortality of listed bats (i.e., people entering caves have purposefully killed bats); however, the extent to which this may occur in the future is unknown.

CONCLUSION

After reviewing the current status of the gray bat, Indiana bat, Virginia big-eared bat, and Ozark big-eared bat, the environmental baseline for the action area, the effects of the proposed activities, and the cumulative effects, it is our biological opinion that the activities, as proposed and including the protective measures described, are not likely to jeopardize the continued existence of the gray bat, Indiana bat, Virginia big-eared bat, or Ozark big-eared bat. Many of the proposed activities have been undertaken by permitted bat biologists for many years without significant effects on listed bat populations and have contributed greatly to their recovery. Therefore, we believe that the implementation of the proposed activities can be accomplished without jeopardizing these four species.

It is also our opinion that the proposed activities are not likely to destroy or adversely modify designated critical habitat for the Indiana bat, Virginia big-eared bat, or Ozark big-eared bat. None of the proposed activities will involve the alteration of critical habitat areas for the Indiana bat, Virginia big-eared bat, or Ozark big-eared bat. Instead, proposed activities either do not involve activities within critical habitat areas (e.g., summer mist netting) or they involve only temporary and short-term disturbances to critical habitat areas (e.g., entering hibernacula to conduct population or WNS monitoring) that are not anticipated to result in permanent modifications of listed bat critical habitat. The risk of WNS transmission by permittees into critical habitat of the Indiana bat was considered as an adverse modification because it could make the site uninhabitable. However, stringent permit conditions on decontamination of gear and clothing will ensure adverse modification will not occur. No critical habitat has been designated for the Virginia big-eared bat or Ozark big-eared bat in the Service's Southeast Region; therefore, none will be affected. Similarly, no critical habitat has been designated for the gray bat; therefore, none will be affected.

Further, we have determined that the activities addressed in this biological opinion are not likely to result in jeopardy to the four bat species at this time because of the reasons outlined in the two previous paragraphs and because:

- (1) The surveillance and monitoring WNS activities will result in low levels of harassment and/or harm to listed bats, except for those individual listed bats that may be euthanized under controlled conditions and circumstances;
- (2) The other activities have been conducted for many years by qualified biologists without significant population effects on these species;
- (3) All categories of activities have incorporated minimization measures via standardized protocols (See Appendix A) that reduce the amount and/or effect of any take that might occur, including activity #11 that involves the selective euthanasia of listed bats.
- (4) To date, we have not received reports of significant bat fatalities during implementation of any non-WNS activities. Permitted biologists, researchers, and facilities have demonstrated that they have the knowledge and experience to collect and handle bats with minimum stress and potential for mortality, and we expect that permits in the future

will only be issued to biologists, researchers, and facilities that have such knowledge and experience in conducting the activities addressed in this biological opinion.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation under section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement provided in a biological opinion.

The measures described below are non-discretionary, and must be undertaken by the Service so that they become binding conditions of any section 10(a)(1)(A) permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The Service has a continuing duty to regulate the activities covered by this incidental take statement. If the Service: (1) fails to assume and implement the terms and conditions or (2) fails to require a permittee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the section 10(a)(1)(A) permit, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, permittees must report the progress of the action, and its impact on the species to the Service as specified in the incidental take statement. [50 CFR Section 402.14(I)(3)]

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The proposed activities are, by their very nature, ripe with variation that does not allow us to derive quantitative take estimates for the four species with any certainty. For example, we expect that incidental take of gray bats, Indiana bats, Ozark big-eared bats, and Virginia big-eared bats due to mortality will be difficult to detect for several reason(s): (1) All four species are small, so finding a dead or injured individual after handling would be difficult; (2) Many of the activities addressed in this biological opinion are conducted at night and consist of handling an individual for a short period and releasing it; (3) Entrance into maternity caves or hibernacula is done once for a short period of time, so it is unlikely that dead or injured individuals would be found so that death or injury could be attributed to that activity; and (4) data to support the use of a surrogate measure of take (e.g., number of cave intrusions per year, cumulative number of mist net nights of sampling, number of harp trap captures, or number of wing punches collected) for the incidental take of individuals is not currently available. For these reasons and because the proposed action is a programmatic action and not a specific, defined action whereby an accurate

take calculation could be made, we have established sidebars for each species that define annual incidental take limits not to be exceeded through implementation of the proposed action. The defined sidebars, in turn, provide support for our jeopardy determination.

In order to define annual incidental take limits for the proposed action, we considered the types and extent of take identified and then evaluated in the effects analysis of this biological opinion. Basically, incidental take of the four endangered bat species will occur in one of two groups of activities (i.e., traditional bat research activities and the selective euthanasia to identify WNS infection of sites and/or species). Traditional bat research activities will cause the harassment of all listed bats as these activities are proposed to take place either with or adjacent to individuals of one or more of the four listed species. Traditional bat research activities may also harm listed bats; however, we do not anticipate that any of these activities will cause injury or death due to the expertise of the biologists doing the work and the standard bat permit conditions put in place to ensure proper avoidance and minimization measures are followed (Also see standard bat permit condition E in Appendix A). While take in the form of injury or death is not expected from these traditional bat research activities, we recognize that situations beyond a permittees control may, albeit rarely, occur resulting in injury or death to a listed bat. Therefore, we have set an annual incidental take (i.e., injury or mortality) threshold (limit) for traditional bat activities by species that are not to be exceeded through implementation of the proposed action.

Table 2. Annual Incidental Take (i.e., injury or mortality) Threshold for Traditional Bat Research Activities by Species.

SPECIES	AMOUNT (individuals)
Gray bat	10
Indiana bat	5
Virginia big-eared bat	1
Ozark big-eared bat	1

The amount of incidental take anticipated from the selective euthanasia to identify WNS infection of sites and/or species is also difficult to estimate. This is because we do not know how many listed bats will actually need to be taken, because (1) the minimization criteria contained in activity #11 should limit the number of situations where a listed bat would be euthanized; (2) we cannot predict how WNS will spread throughout the Southeast Region; and (3) we cannot predict the order in which bat species in any specific hibernacula or summer roost will become infected which is critical in the decision whether a particular individual is euthanized or not. Currently, we can only derive accurate mortality estimates for listed bats that are euthanized during WNS surveillance and monitoring activities but only after the mortalities have occurred. Given this difficulty and the programmatic nature of the proposed action, we have set an annual incidental take (i.e., mortality) threshold (limit) for the selective euthanasia to identify WNS infection of

sites and/or species activity by species that are not to be exceeded through implementation of the proposed action. The annual incidental take limit for each species is based on three main factors: (1) the overall population size; (2) the number of states that have the species within their boundaries; and (3) the amount of time the species spends in caves/mines and thus are more likely to become infected with WNS (i.e., gray bats as well as Virginia and Ozark big-eared bats are cave obligate species that have a increased likelihood of direct contact with *Geomyces destructans* and, therefore, an increased likelihood of being found in caves infected with WNS during both winter hibernation as well as at summer roosting sites).

Table 3. Annual Incidental Take (i.e., mortality) Threshold for Selective Euthanasia Activity by Species, including the number of States with known populations.

SPECIES	# OF STATES	AMOUNT (individuals)
Gray bat	5	20
Indiana bat	6	10
Virginia big-eared bat	2	2
Ozark big-eared bat	1	1

In summary, all listed bats will be harassed as a result of being present during the proposed activities. Furthermore, we have estimated the maximum annual amount of incidental take in the form of injury or mortality) as 30 gray bats, 15 Indiana bats, 3 Virginia big-eared bats, and 2 Ozark big-eared bats that are incidentally or purposefully taken in association with the proposed activities within the Southeast Region that are covered by this biological opinion.

EFFECT OF THE TAKE

In the accompanying biological opinion, we determined that the incidental take resulting from the activities addressed in this biological opinion is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

We believe the following reasonable and prudent measure is necessary and minimizes impacts of incidental take of the gray bat, Indiana bat, Ozark big-eared bat, and Virginia big-eared bat:

1. The Service will ensure that any section 10(a)(1)(A) permits that are issued in the Service’s Southeast Region are based on (a) current biological information for the species and standard practices that have been scientifically derived for the collection and handling of the species addressed in this biological opinion, and (b) an analysis of the

qualifications of permit applicants that demonstrates and provides evidence that permittees are qualified (for new permits) and are adhering to permit conditions (e.g., submitting reports, contacting field offices, etc...) (for amended or renewed permits).

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Service must comply with the following terms and conditions, which carry out the reasonable and prudent measure described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Prior to issuance of any permit in the Service's Southeast Region for the Ozark big-eared bat, the applicant will be required to contact the Service's Ecological Services Field Offices in Tulsa, Oklahoma; Conway, Arkansas; and Frankfort, Kentucky. A copy of the permit request, with a full description of proposed activities to be conducted under the permit will be provided to the Tulsa Office for review and comment.
2. Appropriate field offices in the Service's Southeast Region and appropriate regional offices in other Service regions, will be provided with copies of permit requests for listed bats. Field Office biologists will review the applications to determine the qualifications of the applicant(s) to ensure that they are qualified to perform the proposed activities. The permit will contain appropriate contact information for each state (i.e., Ecological Services and Law Enforcement offices for each state).
3. Permits will include conditions containing contingency procedures in the event that mortality to a listed bat occurs during the performance of proposed activities. Given the history of the ongoing activities authorized by the Service, we do not anticipate injury or mortality to individuals of listed bat species, unless associated with a specific permitted action (e.g., wing punches). If unintended mortality or injury should occur, authorized activities will stop after completion of the current day's activities and the permittee will contact the appropriate Service office noted in the permit conditions by the next workday. Based on discussions between the Service office and the Service's Law Enforcement Division, a decision will be made as to whether or not the authorized activities will be allowed to continue. A decision will also be made as to the disposition of any dead or injured bats.
4. All current and subsequent white nose syndrome-related decontamination protocols approved by the Service and deemed necessary to address the disease, will be followed by permittees covered under Section 10(a)(1)(A) permits.
5. The Service will ensure that all minimization measures discussed in the description of the proposed activities and contained in Appendix A are incorporated as permit conditions for any permits proposing to implement those activities.
6. The Service will ensure that all Permittees provide reports on all covered activities that include estimates and/or actual amounts of incidental or purposeful take that occurs as a result of permitted activities. Such reports must be received on an annual or more frequent basis.

7. The Service shall routinely evaluate the proposed activities to ensure that they are not having adverse effects that exceed those described in this biological opinion or leading to levels of take that are authorized in this biological opinion.

The reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize the impact of incidental take that might otherwise result from the proposed action. If the Service or permittees observe or become aware of incidental take that occurs during implementation of permitted activities that exceeds or is different from the incidental take authorized by this biological opinion, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measure provided. The Service and/or permittee must immediately provide an explanation of the causes of the taking and review, and the Service must evaluate the need for possible modification of the reasonable and prudent measure.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help carry out recovery plans, or to develop information.

We offer the following conservation recommendation(s) for consideration:

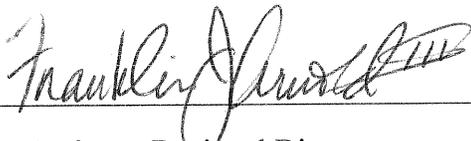
1. The Service should continue its role in finding the cause of white nose syndrome and developing means of managing or eliminating the disease. Funding should continue to entities conducting research to identify causative factors and develop control measures.
2. The Service and its cooperating partners should recognize, protect, and restore habitats within hibernacula that contain microclimate conditions conducive to use by endangered bat species as roosting areas.
3. The Service and its cooperating partners should encourage restriction of human access to caves in an effort to minimize disturbance to bats. This effort may involve the construction of "bat friendly" gates and/or re-building of cave gates that are not "bat friendly".
4. The Service and its cooperating partners should work toward greater knowledge of summer habitat used by the Indiana bat and other listed species. Biologists need to determine the importance of loss of habitat (especially maternity roosting habitat) used by the Indiana bat.
5. The Service and its cooperating partners should pursue information regarding the importance of possible chemical contamination and recovery of the Indiana bat and other bat species.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in this biological opinion. As written in 50 CFR Section 402.16, reinitiation of formal consultation is required where discretionary Fish and Wildlife Service involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the Fish and Wildlife Service action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the Fish and Wildlife Service action is later modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease until reinitiation.

For further coordination please contact Mike Armstrong of my staff at 502/695-0468 x101.

Concur:



Acting Assistant Regional Director

1/24/2011
Date

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APPENDIX A:

SOUTHEAST REGION FINAL STANDARD BAT PERMIT CONDITIONS

C. CONTINUED: TRAINED ASSISTANTS NOT NAMED ON THIS PERMIT MAY WORK ON PERMITTED BAT ACTIVITIES UNDER THE DIRECT AND ON-SITE SUPERVISION OF THE INDIVIDUALS NAMED ABOVE. HOWEVER, TRAINED ASSISTANTS MAY NOT WORK INDEPENDENTLY AT A SITE. TRAINED ASSISTANTS ARE INDIVIDUALS WHO ARE CONSIDERED QUALIFIED BY THE PERMITTED BIOLOGIST(S) TO SELECT SAMPLING SITES, DEPLOY SAMPLING EQUIPMENT AND NETS, AND HANDLE BATS IN THE FIELD AS STATED IN CONDITION F, BELOW.

D. PERMITTEE IS AUTHORIZED TO TAKE (ACOUSTICAL MONITORING, ENTER HIBERNACULA OR MATERNITY ROOST CAVES, SALVAGE DEAD BATS, CAPTURE WITH MIST NETS OR HARP TRAPS, HANDLE, IDENTIFY, COLLECT HAIR SAMPLES, BAND, TRANSMITTER, LIGHT-TAG, WING-PUNCH, AND SELECTIVELY EUTHANIZE FOR WHITE NOSE SYNDROME TESTING) INDIANA BATS (MYOTIS SODALIS), GRAY BATS (MYOTIS GRISESCENS), VIRGINIA BIG-EARED BATS (CORYNORHINUS TOWNSENDII VIRGINIANUS), AND OZARK BIG-EARED BATS (CORYNORHINUS TOWNSENDII INGENS) WHILE CONDUCTING PRESENCE/ABSENCE SURVEYS, STUDIES TO DOCUMENT HABITAT USE, AND POPULATION MONITORING, AS CONDITIONED BELOW.

1. FOR ALL ACTIVITIES CONSIDERED WITHIN THIS PERMIT, THE **DISINFECTION PROTOCOL FOR BAT FIELD STUDIES** SHALL BE FOLLOWED. YOU ARE REQUIRED TO USE THE MOST RECENT PROTOCOLS AVAILABLE. YOU SHALL CONTACT THE SERVICE'S OFFICE LISTED IN M., BELOW FOR A COPY OF THE PROTOCOL EACH YEAR AND TO DETERMINE IF ANY SITE SPECIFIC MODIFICATIONS ARE REQUIRED.
2. UPON DETERMINATION THAT ENDANGERED BATS ARE PRESENT, THE PERMITEE SHALL NOTIFY THE SERVICE FIELD OFFICE IN THE STATE IN WHICH THE SITE IS LOCATED AND THE CORRESPONDING REGIONAL OFFICE BY PHONE AND/OR VIA E-MAIL WITHIN TWO (2) BUSINESS DAYS OF DETERMINATION.
3. DEAD BATS MAY BE SALVAGED AND IDENTIFIED (INCLUDING PHOTOGRAPHIC DOCUMENTATION), AND SENT TO THE APPROPRIATE LAB FACILITIES FOR THE PURPOSES OF EVALUATING IMPACTS FROM THE CAUSE OF DEATH (WHITE-NOSE SYNDROME, WIND ENERGY OPERATIONS, ETC.). ANY DISCOVERY OF FEDERALLY LISTED SPECIMENS SHALL BE REPORTED, WITHIN 48 HOURS OF DISCOVERY, TO THE USFWS FIELD SUPERVISOR IN THE STATE IN WHICH THE SALVAGE OCCURS. YOUR REPORT MUST BE IN WRITING AND/OR VIA E-MAIL AND MUST INCLUDE INFORMATION ON THE SPECIES, SEX, LOCATION, DATE, TIME, AND ANY OBSERVATIONS ON THE CONDITION OF THE SPECIMEN. SPECIMENS MUST BE CHILLED AND SURRENDERED TO THE OFFICE IN CONDITION M., BELOW, UNLESS OTHERWISE INSTRUCTED BY THAT OFFICE.

4. BATS MAY BE CAPTURED WITH MIST NETS AND HARP TRAPS. THE MONITORING INTERVAL FOR MIST NETS MAY NOT EXCEED 10 MINUTES. BATS MAY BE CAPTURED WITH HARP TRAPS ONLY WITH WRITTEN CONCURRENCE FROM THE FIELD SUPERVISOR IN THE STATE IN WHICH TRAPPING IS PROPOSED. HARP TRAPS MUST BE CONTINUALLY MONITORED. CAPTURED BATS MAY NOT BE HELD FOR MORE THAN 30 MINUTES, UNLESS INJURED. FOR ESA COMPLIANCE PROJECTS INVOLVING SURVEY WORK FOR THE INDIANA BAT IN KENTUCKY, INDIVIDUALS REFERENCED IN CONDITION C. ABOVE MUST FOLLOW THE INDIANA BAT SURVEY GUIDANCE ISSUED BY THE U.S. FISH AND WILDLIFE SERVICE, KENTUCKY FIELD OFFICE AND KENTUCKY DEPARTMENT OF FISH AND WILDLIFE RESOURCES. FOR INDIANA BAT SURVEY WORK CONDUCTED IN KENTUCKY, THIS GUIDANCE SUPERCEDES OTHER CONDITIONS LISTED IN THIS PERMIT; THE GUIDANCE MUST BE CURRENT FOR THE YEAR IN WHICH THE SURVEY IS CONDUCTED.
5. PERMITTEES MAY CARRY OUT NON-INTRUSIVE MEASUREMENTS ON CAPTURED BATS.
 - a. UNIQUELY NUMBERED, MODERN, LIPPED, CORRECTLY SIZED ALUMINUM BAT BANDS SHALL BE USED. SPLIT-RING, PLASTIC BANDS SHALL BE AVOIDED.
 - b. FECAL MATERIAL MAY BE COLLECTED AFTER A BAT IS CAPTURED BY PLACING IT IN A CLOTH BAG FOR A SHORT TIME (NOT TO EXCEED 30 MINUTES) BEFORE IT IS CAREFULLY EXAMINED AND KEY PHYSICAL CHARACTERS DOCUMENTED. FECAL MATERIAL CAN THEN BE REMOVED FROM THE BAG OR COLLECTED OFF THE FUR OF THE BAT.
6. LIGHT TAGS MAY BE ATTACHED TO THE DORSAL FUR OF A BAT WITH A NONTOXIC ADHESIVE THAT WILL QUICKLY DEGRADE AND LOOSE ITS ADHESIVE QUALITIES. THE SMALLEST AND LIGHTEST CYALUME CAPSULES THAT WILL MEET THE PROJECT OBJECTIVES SHALL BE USED.
7. WING PUNCHES AND/OR FUNGAL TAPE-LIFT SAMPLES MAY BE TAKEN IN SPRING/SUMMER FROM BATS THAT HAVE PHYSICAL SYMPTOMS TO SUGGEST THAT THE BAT MAY BE HARBORING THE FUNGUS ASSOCIATED WITH WHITE-NOSE SYNDROME. PHYSICAL SYMPTOMS INCLUDE A WHITE FUNGUS ON AREAS OF EXPOSED SKIN INCLUDING THE WINGS, FOREARMS, EARS, TAIL, AND/OR AROUND THE MUZZLE. PHYSICAL SYMPTOMS ALSO WOULD INCLUDE A WING SCARRING SCORE OF ONE OR ABOVE FOLLOWING THE REICHARD WING DAMAGE INDEX. WING BIOPSIES AND FUNGAL TAPE-LIFT SAMPLES SHALL BE TAKEN IN ACCORDANCE WITH THE MOST RECENT PROTOCOLS AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY NATIONAL WILDLIFE HEALTH CENTER IN MADISON, WISCONSIN. THE NATIONAL WILDLIFE HEALTH CENTER SHALL BE CONTACTED EACH YEAR FOR A COPY OF THE MOST RECENT PROTOCOL. WING PUNCHES SHALL AVOID BONES AND MAJOR BLOOD VESSELS AND A SEPARATE BIOPSY TOOL MUST BE USED FOR EACH INDIVIDUAL LISTED BAT.
8. RADIO TRANSMITTERS (TOTAL PACKAGE WEIGHT NOT TO EXCEED 5 PERCENT OF BODY WEIGHT OR 0.45 GRAM, WHICHEVER IS LESS) MAY BE ATTACHED TO BATS DURING THE SPRING, SUMMER, AND FALL ROOSTING PERIODS BY NONTOXIC

SKIN BOND ADHESIVE. BATS CARRYING TRANSMITTERS SHOULD BE MONITORED DAILY FOR AT LEAST FIVE DAYS, OR UNTIL THE TRANSMITTER FALLS OFF, WHICHEVER OCCURS FIRST. RADIO TRANSMITTERS SHALL NOT BE PLACED ON NEWLY VOLANT JUVENILES WITHOUT PRIOR APPROVAL OF THE USFWS FIELD SUPERVISOR IN THE STATE WHERE THE WORK OCCURS.

9. SURVEYS OF GRAY BAT AND/OR VIRGINIA BIG-EARED BAT MATERNITY ROOSTS AND THEIR OTHER KNOWN SUMMER ROOST SITES SHALL BE CONDUCTED BY OBSERVING THE BATS WITH NIGHT VISION EQUIPMENT AND INFRARED LIGHT SOURCE AS THEY EMERGE FROM THEIR CAVES AND MINE ROOSTS. AT SITES THAT ARE NOT CURRENTLY KNOWN TO SUPPORT THESE SPECIES, THE ACCEPTED METHOD TO DETERMINE IF THEY ARE PRESENT IS TO CAREFULLY AND SLOWLY ENTER THE POTENTIAL ROOST SITE AND VISUALLY CHECK FOR EVIDENCE OF THE PRESENCE OF BATS, SUCH AS SIGNIFICANT QUANTITIES OF GUANO, A STRONG SMELL OF GUANO OR THE AUDIBLE SOUNDS PRODUCED BY BATS ROOSTING AT THE SITE. ONCE ANY OF THE INDICATORS ARE OBSERVED, SURVEY TEAM MEMBERS SHALL EXIT THE ROOST SITE AND MAKE FURTHER OBSERVATIONS FROM OUTSIDE THE ENTRANCE TO THE ROOST. ALL FURTHER OBSERVATIONS (WITH ACUOSTICS AND/OR NIGHT VISION EQUIPMENT AND A SUPPLEMENTAL INFRARED LIGHT SOURCE) SHALL BE MADE FROM THE CAVE OR MINE ENTRANCE DURING THE EVENING EMERGENCE. FOR CAVE ENTRY ACTIVITIES, WRITTEN APPROVAL IS REQUIRED FROM THE USFWS FIELD SUPERVISOR FOR THE STATE IN WHICH THE ACTIVITIES ARE PROPOSED.
10. AT SOME SITES, ESPECIALLY ABANDONED MINES, IT IS NOT ADVISABLE TO ENTER A POTENTIAL ROOST BECAUSE OF THE PHYSICAL HAZARDS PRESENT IN THE SITE. ACOUSTICAL MONITORING, MIST NETS, OR HARP TRAPS MAY BE USED OUTSIDE THE ENTRANCE OF THESE SITES TO DETERMINE THE IDENTITY, SEX AND REPRODUCTIVE CONDITION OF BATS USING THE SITE. NETS AND HARP TRAPS SHALL BE CHECKED REGULARLY AND THE MONITORING INTERVAL FOR MIST NETS MAY NOT EXCEED 10 MINUTES. CAPTURED BATS SHALL NOT BE HELD FOR MORE THAN 30 MINUTES, UNLESS INJURED. DATA SHALL BE RECORDED FOR ALL BATS REMOVED FROM THE NET AND/OR TRAP. THESE DATA SHALL INCLUDE SPECIES, SEX, REPRODUCTIVE CONDITION, AND PHYSICAL MEASUREMENTS SUCH AS FOREARM LENGTH, FOOT LENGTH, PRESENCE/ABSENCE OF A KEEL ON THE CALCAR, ETC. INDIANA BATS, VIRGINIA BIG-EARED BATS, AND OZARK BIG-EARED BATS MUST BE PHOTOGRAPHED BEFORE RELEASE TO DOCUMENT THEIR PRESENCE AT THE ROOST SITE AND SUCH PHOTOGRAPHS PROVIDED DURING THE PERMITTE'S REPORTING EFFORTS.
11. IF IT IS NECESSARY TO DOCUMENT REPRODUCTIVE LEVELS WITHIN A GRAY BAT OR VIRGINIA BIG-EARED BAT MATERNITY ROOST, THE ROOST MAY BE ENTERED AFTER THE EVENING EMERGENCE OF ADULTS HAS BEEN COMPLETED. ENTRY SHALL BE LIMITED TO SMALLEST NUMBER OF PEOPLE THAT CAN SAFELY ACCOMPLISH THE SURVEY AND ALL SURVEY TEAM MEMBERS WILL EXIT THE ROOST SITE PRIOR TO THE RETURN OF ADULTS TO THE ROOST. THIS ACTIVITY REQUIRES WRITTEN APPROVAL FROM THE USFWS FIELD SUPERVISOR FOR THE STATE IN WHICH ACTIVITIES ARE PROPOSED.

SURVEYS CONDUCTED DURING THE WINTER HIBERNATION SEASON SHALL FOLLOW THE GUIDELINES ESTABLISHED IN THE RECOVERY PLANS FOR LISTED

BAT SPECIES. BATS MAY BE HANDLED DURING WINTER SURVEYS IN ORDER TO COLLECT BAND INFORMATION AND CONFIRM THE IDENTIFICATION OF LISTED SPECIES. DETAILED PHOTOGRAPHS SHOULD BE TAKEN TO DOCUMENT THE PRESENCE OF LISTED SPECIES. ONLY ONE TRIP TO THE HIBERNATION AREA OF EACH CAVE OR ABANDONED MINE IS AUTHORIZED DURING THE HIBERNATION SEASON WITHOUT THE SUBSEQUENT WRITTEN APPROVAL OF THE USFWS FIELD SUPERVISOR FOR THE STATE IN WHICH ACTIVITIES ARE PROPOSED. INDIANA BAT, GRAY BAT, AND VIRGINIA BIG-EARED BAT HIBERNATION SITES SHALL ONLY BE SURVEYED ONCE EVERY TWO YEARS.

12. WHEN CONDUCTING INDIANA BAT SURVEYS, THE CURRENT MINIMUM SURVEY GUIDANCE CONTAINED IN THE 2007 DRAFT INDIANA BAT RECOVERY PLAN SHALL BE FOLLOWED; HOWEVER, THE PERMITTEE MUST ADHERE TO ANY ADDITIONAL, SPECIFIC GUIDANCE DEVELOPED FOR THE STATE IN WHICH THEIR PROJECT IS LOCATED. DEVIATION FROM THESE GUIDELINES IS NOT AUTHORIZED VIA THIS PERMIT AUTHORIZATION. HOWEVER, WE ENCOURAGE THE USE OF ECHOLOCATION DETECTION EQUIPMENT TO SUPPLEMENT THE INFORMATION GAINED DURING MIST NET SURVEYS. AT THIS TIME, ECHOLOCATION DETECTION CANNOT BE USED TO POSITIVELY IDENTIFY ALL SPECIES OF BATS THAT MAY BE ENCOUNTERED DURING SUMMER SURVEYS AND, THEREFORE, IT CANNOT BE USED TO POSITIVELY ESTABLISH PRESENCE WITHIN THE SURVEY AREA. NO TRAPPING ACTIVITIES SHALL OCCUR WITHIN 20 METERS OF AN INDIANA BAT MATERNITY ROOST SITE, UNLESS THE PERMITTEE RECEIVES WRITTEN APPROVAL FROM THE USFWS FIELD SUPERVISOR FOR THE STATE IN WHICH ACTIVITIES ARE PROPOSED.
13. UNDER THE FOLLOWING SPECIFIC CONDITIONS RELATED TO WHITE-NOSE SYNDROME (WNS), LISTED BATS MAY BE EUTHANIZED: (A) THE SITE OF COLLECTION HAS NOT BEEN PREVIOUSLY DEMONSTRATED TO CONTAIN WNS-INFECTION OR WNS-INFECTED BATS (LISTED AND/OR NON-LISTED), (B) NO OTHER NON-LISTED BATS ARE PRESENT THAT ALSO SHOW SYMPTOMS OF WNS, AND (C) NO OTHER METHOD OF WNS SAMPLE COLLECTION IS POSSIBLE. IN ADDITION, ONLY ONE LISTED BAT OF ANY SPECIES WILL BE COLLECTED AT A SINGLE ROOST SITE AND ONLY IF CRITERIA (A), (B), AND (C) ARE MET AND THOSE CIRCUMSTANCES DOCUMENTED BY THE PERMITTEE IN WRITING TO THE SERVICE.

WHEN MORE THAN ONE LISTED BAT SPECIES IS PRESENT WITHIN A SITE AND SHOWING SYMPTOMS OF WNS, THE FOLLOWING ORDER SHOULD BE USED IN SELECTING WHICH INDIVIDUAL TO SELECTIVELY EUTHANIZE FOR WNS TESTING: A GRAY BAT SHALL BE SELECTED BEFORE AN INDIANA BAT BEFORE A VIRGINIA BIG-EARED BAT BEFORE AN OZARK BIG-EARED BAT.

14. PRIOR TO CONDUCTING ACTIVITIES IN NORTH CAROLINA, LOUISIANA, ARKANSAS AND TENNESSEE (FOR TENNESSEE-ONLY WHEN ENTRY OF CAVES IS ANTICIPATED), WRITTEN APPROVAL SHALL BE RECEIVED FROM THE PERMIT COORDINATOR LISTED IN CONDITION N1., BELOW:
15. PRIOR TO CONDUCTING ACTIVITIES IN IOWA, MISSOURI, ILLINOIS, INDIANA,

WISCONSIN, MICHIGAN, AND OHIO, WRITTEN APPROVAL SHALL BE RECEIVED FROM THE PERMIT COORDINATOR LISTED IN CONDITION N2., BELOW:

16. PRIOR TO CONDUCTING ACTIVITIES IN WEST VIRGINIA, MASSACHUSETTS, VERMONT, RHODE ISLAND, NEW HAMPSHIRE, AND VIRGINIA, WRITTEN APPROVAL SHALL BE RECEIVED FROM THE PERMITS COORDINATOR LISTED IN CONDITION N3., BELOW.
17. PRIOR TO CONDUCTING ACTIVITIES IN OKLAHOMA, WRITTEN APPROVAL SHALL BE RECEIVED FROM THE PERMITS COORDINATOR LISTED IN CONDITION N4., BELOW.
18. PRIOR TO CONDUCTING ACTIVITIES IN KANSAS, WRITTEN APPROVAL SHALL BE RECEIVED FROM THE PERMITS COORDINATOR LISTED IN CONDITION N5., BELOW.
19. COPIES OF ALL REQUEST AND APPROVAL LETTERS, WITH THE PERMIT NUMBER INCLUDED, SHALL BE FORWARDED TO THE PERMITS COORDINATOR LISTED IN CONDITION L., BELOW.
20. THE LETTER OF INSTRUCTION, BAT CAVE ADVISORY, AND DISINFECTION PROTOCOL – AND ANY SUBSEQUENT VERSIONS OF THESE ATTACHMENTS SHALL BE FOLLOWED.

E. NO BAT INJURY OR MORTALITY IS ANTICIPATED AS A RESULT OF THE IMPLEMENTATION OF THE AUTHORIZED ACTIVITIES, EXCEPT AS EXPLICITLY STATED IN CONDITION D13 ABOVE OR RARELY UNDER SITUATIONS BEYOND A PERMITTEES CONTROL FROM ACTIVITIES DESCRIBED IN CONDITIONS D4-D12. IF ANY INJURY OR MORTALITY DOES OCCUR, THE PERMITTEE SHALL IMMEDIATELY NOTIFY THE APPROPRIATE U.S. FISH AND WILDLIFE SERVICE OFFICES NOTED IN CONDITION M., BELOW. NOTIFICATION SHALL ALSO BE MADE WITHIN 24 HOURS TO THE REGIONAL PERMITS BIOLOGIST, AT THE ADDRESS AND TELEPHONE NUMBER NOTED IN CONDITION L., BELOW. BASED ON DISCUSSIONS WITH THESE OFFICES, A DECISION WILL BE MADE AS TO WHETHER ANY OF THE AUTHORIZED ACTIVITIES CAN CONTINUE. DECISIONS WILL ALSO BE MADE CONCERNING THE DISPOSITION OF ANY DEAD OR INJURED BATS. THE PERMITTEE SHALL PROVIDE A WRITTEN STATEMENT TO THE U.S. FISH AND WILDLIFE SERVICE OFFICES NOTED IN CONDITIONS L. AND M., BELOW, WHICH DOCUMENTS THE CAUSE OF THE INJURY/MORTALITY, AND IDENTIFIES THE REMEDIAL MEASURES EMPLOYED BY THE PERMITTEE TO ELIMINATE FUTURE MORTALITY/INJURY EVENTS. THE FINAL DECISION ON REMEDIAL MEASURES RESTS WITH THE U.S. FISH AND WILDLIFE SERVICE.

F. THIS PERMIT IS NON-TRANSFERABLE, BUT OTHER QUALIFIED PERSONNEL MAY ASSIST IN THE AUTHORIZED ACTIVITIES, SUBJECT TO THE REQUIREMENTS OF §13.25. WHEN ANY SUCH ASSISTANCE IS TO BE PROVIDED, THOSE DESIGNATIONS ARE TO BE MADE BY LETTER FROM THE PERMITTEE TO EACH AGENT. THE LETTER(S) MUST

IDENTIFY THE SCOPE AND DURATION OF THE ASSISTANCE TO THE PERMITTEE. COPIES OF SUCH LETTERS WILL BE PROVIDED IMMEDIATELY TO THE U.S. FISH AND WILDLIFE SERVICE'S REPORTING ADDRESSES LISTED IN CONDITIONS L, M. AND N., BELOW, AS APPROPRIATE. THE PERMITTEE MUST BE PRESENT ON SITE AT ALL TIMES WHILE ACTIVITIES AUTHORIZED UNDER THIS PERMIT ARE BEING CARRIED OUT.

G. PERMITTEE MUST CARRY A COPY OF THIS PERMIT AT ALL TIMES WHEN CONDUCTING THE AUTHORIZED ACTIVITIES. SHIPMENTS OF COLLECTED BIOLOGICAL MATERIALS SHOULD ALSO BE ACCOMPANIED BY A COPY OF THIS PERMIT. NOTE THAT THIS PERMIT IS LIMITED TO THE ABOVE ACTIVITIES AND IDENTIFIED SPECIES.

H. ISSUANCE OF THIS PERMIT DOES NOT CONSTITUTE PERMISSION TO CONDUCT THESE ACTIVITIES ON NATIONAL WILDLIFE REFUGES OR ANY OTHER PUBLIC OR PRIVATE LANDS; SUCH PERMISSION MUST BE OBTAINED SEPARATELY FROM THE APPROPRIATE LANDOWNER OR LAND MANAGER BEFORE BEGINNING THESE AUTHORIZED ACTIVITIES. THIS PERMIT, NEITHER DIRECTLY NOR BY IMPLICATION, GRANTS THE RIGHT OF TRESPASS.

I. ACCEPTANCE OF THIS PERMIT SERVES AS EVIDENCE THAT THE PERMITTEE AND ITS AUTHORIZED AGENTS UNDERSTAND AND AGREE TO ABIDE BY THE TERMS OF THIS PERMIT AND ALL SECTIONS OF TITLE 50 CODE OF FEDERAL REGULATIONS, PARTS 13 AND 17, PERTINENT TO ISSUED PERMITS. SECTION 11 OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED, PROVIDES FOR CIVIL AND CRIMINAL PENALTIES FOR FAILURE TO COMPLY WITH PERMIT CONDITIONS.

J. UPON LOCATING A DEAD, INJURED, OR SICK BAT, OR ANY OTHER THREATENED OR ENDANGERED SPECIES, UNDER CIRCUMSTANCES NOT ADDRESSED IN THIS AUTHORIZATION, INITIAL NOTIFICATION MUST BE MADE IMMEDIATELY TO THE U.S. FISH AND WILDLIFE SERVICE FIELD OFFICE IDENTIFIED IN CONDITION M., BELOW. NOTIFICATION SHOULD ALSO BE MADE BY THE NEXT WORK DAY TO THE U.S. FISH AND WILDLIFE SERVICE OFFICE IDENTIFIED IN CONDITION L., BELOW. CARE SHOULD BE TAKEN IN HANDLING SICK, INJURED, OR DEAD SPECIMENS TO ENSURE EFFECTIVE TREATMENT OR TO PRESERVE BIOLOGICAL MATERIALS FOR LATER ANALYSIS. IN CONJUNCTION WITH THE CARE OF SICK OR INJURED ENDANGERED OR THREATENED SPECIES, AND THE PRESERVATION OF BIOLOGICAL MATERIALS FROM A DEAD ANIMAL, THE FINDER SHOULD TAKE RESPONSIBLE STEPS TO ENSURE THAT THE SITE IS NOT UNNECESSARILY DISTURBED.

K. AN ANNUAL REPORT SUMMARIZING AUTHORIZED ACTIVITIES MUST BE SUBMITTED BY DECEMBER 31 OF EACH YEAR THIS PERMIT IS VALID. EACH REPORT MUST INCLUDE, AT A MINIMUM, THE FOLLOWING INFORMATION:

1. TOTAL NUMBER OF SURVEYS CONDUCTED AND LOCATIONS OF THE TRAPPING AND SURVEY SITES. LOCATIONS SHALL BE NOTED USING FIGURES, MAPS, AND BY REFERENCING THE NAD83 COORDINATE SYSTEM (E.G., DEGREES, MINUTES, SECONDS).

2. PERMITTEES MUST COMPLETE AND SUBMIT REGION 4'S ELECTRONIC BAT COLLECTION DATA SUBMISSION FORM

3. FOR EACH RESEARCH/MONITORING ACTIVITY IN WHICH FEDERALLY LISTED BATS ARE "TAKEN" (AS DEFINED IN THE REGION 4 BIOLOGICAL OPINION FOR THE SECTION 10 PERMITTING PROGRAM), PERMITTEES MUST PROVIDE ELECTRONIC COPIES OF ALL PUBLICATIONS AND/OR REPORTS GENERATED FROM FIELD ACTIVITIES.

L. FOR PURPOSES OF MONITORING COMPLIANCE AND ADMINISTRATION OF THE TERMS AND CONDITIONS OF THIS PERMIT, THE CONTACT OFFICE OF THE U.S. FISH AND WILDLIFE SERVICE IS:

U.S. FISH AND WILDLIFE SERVICE

ATTN: PERMIT COORDINATOR

1875 CENTURY BOULEVARD, SUITE 200

ATLANTA, GEORGIA 30345-3301

TELEPHONE: 904/731-3191 OR 404/679-7089

FACSIMILE: 904/731-3045 OR 404/679-7081

M. COPIES OF ANNUAL REPORTS SHALL ALSO BE SENT TO THE FOLLOWING:

FIELD SUPERVISOR

U.S. FISH AND WILDLIFE SERVICE

J.C. WATTS FEDERAL BUILDING

330 WEST BROADWAY, ROOM 265

FRANKFORT, KENTUCKY 40601

TELEPHONE: 502/695-0468

FACSIMILE: 502/695-1024

N. CONTACT INFORMATION FOR U.S. FISH AND WILDLIFE SERVICE STATE FIELD OFFICES AND REGIONS REQUIRING PRIOR APPROVAL;

1. FIELD SUPERVISOR
U.S. FISH AND WILDLIFE SERVICE
551-F PYLON DRIVE
P.O. BOX 33726
RALEIGH, NORTH CAROLINA 27363
TELEPHONE: 919/856-4520

FIELD SUPERVISOR
U.S. FISH AND WILDLIFE SERVICE
160 ZILICOA STREET
ASHEVILLE, NORTH CAROLINA 28801
TELEPHONE: 828/258-3939

FIELD SUPERVISOR
U.S. FISH AND WILDLIFE SERVICE
646 CAJUNDOME BOULEVARD
SUITE 400
LAFAYETTE, LOUISIANA 70506
TELEPHONE: 337/291-3124

FIELD SUPERVISOR
U.S. FISH AND WILDLIFE SERVICE
446 NEAL STREET
COOKEVILLE, TENNESSEE 38501
TELEPHONE: 931/528-6481

FIELD SUPERVISOR
U.S. FISH AND WILDLIFE SERVICE
110 SOUTH AMITY ROAD
SUITE 300
CONWAY, ARKANSAS 72032
TELEPHONE: 501/513-4470

2. U.S. FISH AND WILDLIFE SERVICE
DIVISION OF ENDANGERED SPECIES
1 FEDERAL DRIVE
FORT SNELLING, MINNESOTA 55111-4056
TELEPHONE: 612/713-5343

FACSIMILE: 612/713-5292

3. U.S. FISH AND WILDLIFE SERVICE
DIVISION OF ENDANGERED SPECIES
300 WESTGATE CENTER DRIVE
HADLEY, MASSACHUSETTS 01035-9589
TELEPHONE: 413/253-8627

4. U.S. FISH AND WILDLIFE SERVICE
OKLAHOMA ECOLOGICAL SERVICES FIELD OFFICE
9014 E. 21ST STREET
TULSA, OKLAHOMA 74129
TELEPHONE: 918/581-7458

5. U.S. FISH AND WILDLIFE SERVICE
KANSAS ECOLOGICAL SERVICES FIELD OFFICE
2609 ANDERSON AVENUE
MANHATTAN, KANSAS 66502
TELEPHONE: 785/539-3474