

DRAFT REVISED
RANGEWIDE INDIANA BAT SUMMER SURVEY GUIDELINES
January 2013

The following guidance is designed to provide standardized, rangewide guidelines and protocols and to determine whether Indiana bats (*Myotis sodalis*) are present or likely absent at a given site during the summer (May 15 to August 15). The following phased approach, which includes habitat assessments, as well as acoustic, mist-net, radio-tracking, and emergence surveys, once finalized, will supersede the 2007 Indiana Bat Mist-Netting Guidelines. Future changes to this guidance are likely and will be posted on the U.S. Fish and Wildlife Service's (USFWS) Indiana bat website (<http://www.fws.gov/midwest/Endangered/mammals/inba/index.html>). Please check this website to ensure use of the most current version of the guidance.

GENERAL PROCESS

The following guidance was designed in an attempt to determine presence or probable absence of Indiana bats in an area of interest but are not intended to be rigorous enough to provide sufficient data to fully determine population size or structure. Following this guidance will help: 1) standardize range-wide survey procedures; 2) maximize the potential for detection/capture of Indiana bats at a minimum acceptable level of effort; and 3) ensure that survey results are sufficient to be accepted by the USFWS for regulatory purposes. Although acoustic detections and/or capture of Indiana bats confirm their presence, failure to acoustically detect or catch them does not absolutely confirm their absence (i.e., no currently-available bat survey techniques provide 100% detection).

As a reminder, the first step for determining presence of Indiana bats at a given site is to determine whether there is any existing occurrence data available for the vicinity of the project. Project sponsors should coordinate with the USFWS Ecological Services Field Office (USFWS FO) and state natural resource agency for information on known occurrence locations. Please note that recommendations may be modified in areas that are already known to be occupied by Indiana bats during part of the year (i.e., spring staging, summer, fall swarming, and/or winter).

Indiana bat surveys for some proposed projects will require modification (or clarification) of this guidance. These situations must be resolved through coordination with the USFWS FO responsible for the state in which the project occurs. Consultation with the USFWS FO is always recommended and may be required by federal permits. Implementing this survey guidance without prior coordination with the USFWS FO may result in invalid or unacceptable conclusions for regulatory purposes. An online directory of USFWS FO(s) is available at <http://www.fws.gov/offices/directory/listofficemap.html>. Unless otherwise agreed to by the USFWS, negative acoustic survey results obtained using this guidance are valid for two years¹ from the completion of the acoustic survey.

¹ The timeframe may be reduced if significant habitat changes have occurred in the area.

Both acoustic and mist-net surveys should be conducted in the best suitable habitat possible for each survey type to increase the likelihood of detecting/capturing Indiana bats. In some cases, the most suitable habitat for effectively conducting surveys may occur outside a project site boundary and may be sampled. However, if proposed sample sites are more than 1,000 feet (305 meters) from the project site boundary, then the USFWS FO should be consulted. All efforts should be made to coordinate with adjacent landowners to obtain appropriate authorizations and to ensure the best possible sites are surveyed.

There are four phases of surveys in this guidance, each dependent upon positive results of the prior phase (see Figures 1 and 2):

- Phase 1- Summer Habitat Assessments
- Phase 2- Acoustic Surveys
- Phase 3- Mist-net Surveys
- Phase 4- Radio-tracking and Emergence Surveys

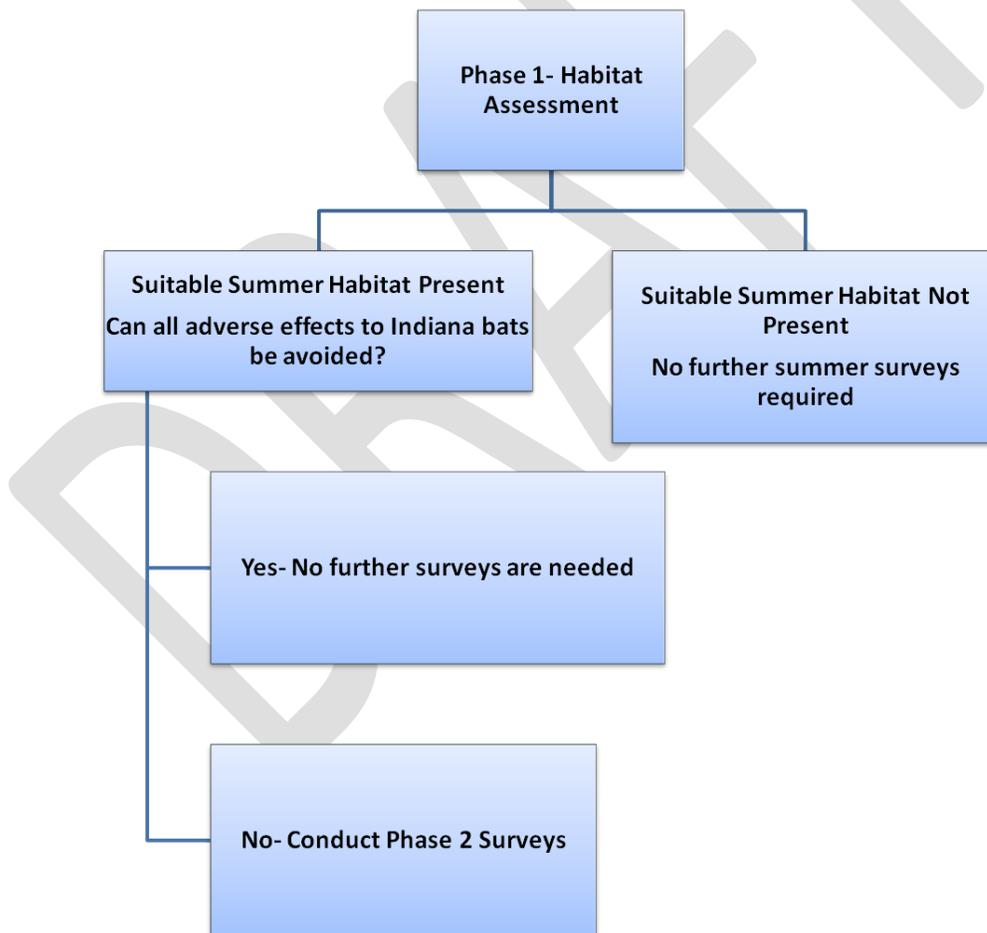


Figure 1. Indiana Bat Survey Guidance Decision Tree for Phase 1

PHASE 1 – SUMMER HABITAT ASSESSMENTS

After coordinating with the USFWS FO to determine known Indiana bat occurrences, the next step in determining whether Indiana bats may be present at a given site is to assess whether there is any suitable Indiana bat summer habitat present. Habitat assessments can be completed any time of the year and ideally would be submitted to the USFWS FO(s) for review and approval well in advance of the summer survey period. Habitat assessments should be conducted for any projects that have the potential to impact Indiana bats within areas identified by the USFWS as being within the range of the Indiana bat:

(<http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A000>).

Suitable summer habitat for Indiana bats consists of the variety of forested/wooded habitats where they roost, forage, and travel, as well as surrounding non-forested habitats (e.g., agricultural fields, emergent wetlands, old fields, pasture). This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags greater than 3 inches² (7.6 centimeters) diameter-at-breast-height (dbh) that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. Habitat assessment guidelines are in Appendix A.

If there is no suitable Indiana bat summer habitat present in the project area, no summer surveys for Indiana bats are necessary. If there is any suitable habitat, coordinate with the USFWS FO(s) regarding any impacts assessments for the proposed project. In addition, further coordination with the USFWS FO(s) may be necessary if known or potential migrating, swarming, or hibernating habitat is present in the project area.

If suitable Indiana bat summer habitat is present, proceed to Phase 2- Acoustic Surveys and submit the habitat assessment report and draft study plan for conducting acoustic surveys to the USFWS FO(s) for review and concurrence. Project modifications (e.g., inclusion of appropriate avoidance and minimization measures) may be possible at this phase in consultation with the USFWS FO(s) so that no additional surveys are needed.

² While any tree greater than 3 inches dbh (7.6 centimeters) with exfoliating bark, cracks, crevices, and/or hollows has the potential to be male Indiana bat summer roosting habitat, even-aged stands of 3-inch dbh and smaller trees are not defined as suitable roosting habitat for the purposes of this guidance. Suitable roosting habitat is defined as forest patches with trees of greater than or equal to 5 inches dbh (12.7 centimeters), although trees as small as 3 inches within the forest patch(es) may also be included.

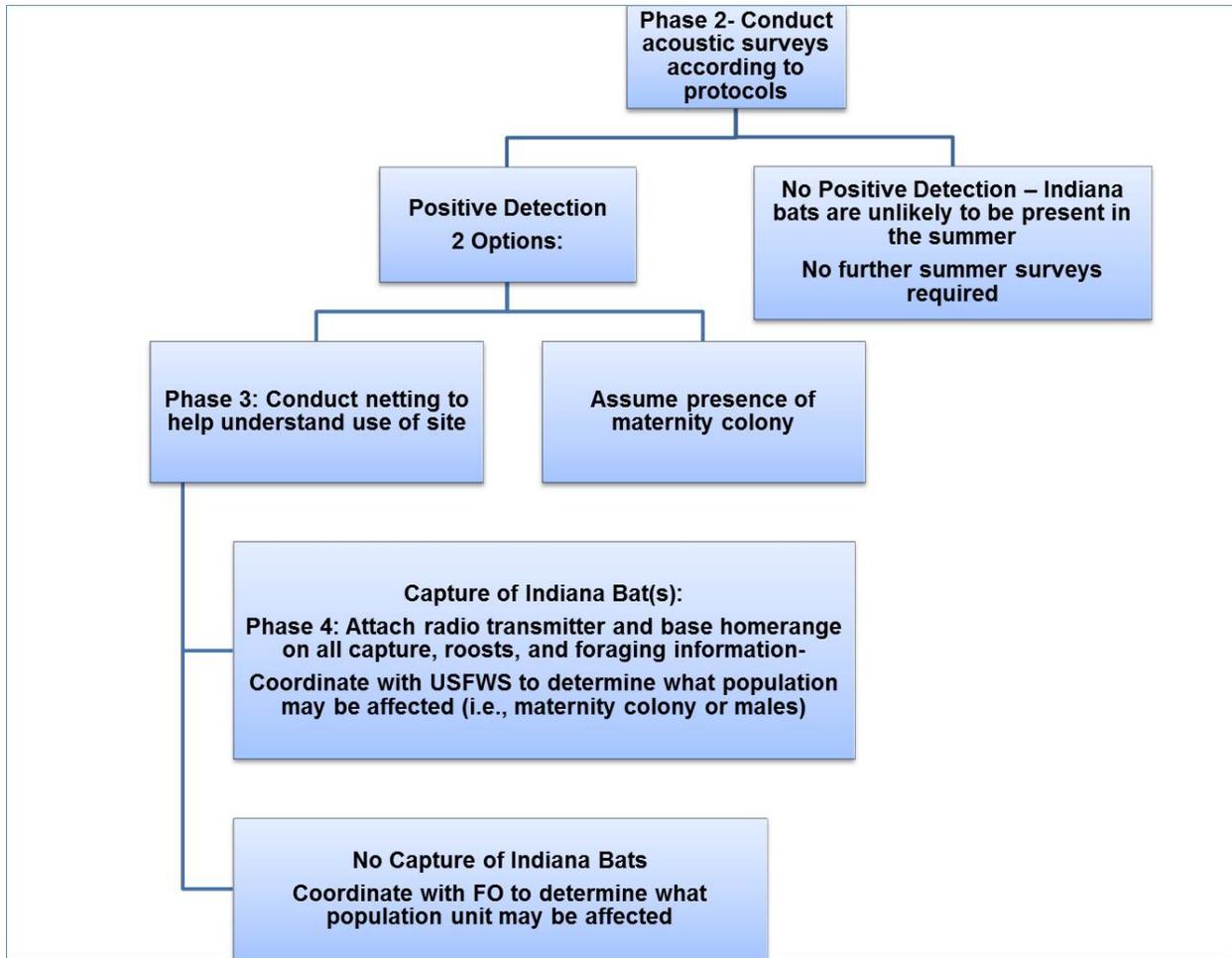


Figure 2. Indiana Bat Survey Guidance Decision Tree Phase 2-4

PHASE 2 - ACOUSTIC SURVEYS

Acoustic surveys can be completed between May 15 and August 15 to determine whether Indiana bats may be present on-site, following the protocol described in Appendix B. If the acoustic surveys do not indicate that Indiana bats are present, no further summer surveys are needed. Submit negative results of the surveys to the local USFWS FO(s) for review and concurrence.

If the acoustic surveys indicate that Indiana bats are present, then the project proponent should mist-net in an attempt to capture recorded bats, although the option exists to assume the presence of a maternity colony without additional surveys. It is advantageous for project proponents to have biologists capture, track, and count Indiana bats initially detected with acoustics. The resulting information collected from radio-tagged bats greatly improves the USFWS's understanding about the type and level of bat presence (i.e., maternity or non-maternity) and their use of an area (e.g., focal roost sites), which facilitates the design of appropriate conservation measures and ultimately the analysis of project effects on the species. For example, evidence suggesting that maternity roosts are located off-site will typically benefit a project

proponent. If mist-netting is not conducted and no additional site-specific data are generated, then the USFWS FO(s) will have to assume a reasonable worst-case scenario (e.g., presence of a maternity colony(ies) roosting within suitable habitat within the middle of the project area boundary), and therefore, will require the most conservative measures for the protection of the species.

If the acoustic survey results indicate that Indiana bats are present, and the project proponent wishes to conduct mist-netting to better determine the use of the site by Indiana bats, then it is recommended that the project proponent prepare and submit a draft Phase 3/4 study plan to the local USFWS FO concurrent with the acoustic survey report. Although mist-netting does not have to be completed during the same field season as the acoustics, it is recommended to do so, and applicants would need to plan ahead accordingly to accomplish it.

PHASE 3- MIST-NETTING AND PHASE 4- RADIO-TRACKING/ EMERGENCE SURVEYS

Mist-netting should be completed between May 15³ and August 15 in project areas previously confirmed as Indiana bat habitat by means of acoustic surveys. Mist-netting is designed to capture Indiana bats so that their gender, age, and reproductive condition can be determined. Additionally, captured bats may be banded (not required by USFWS; contact the applicable state natural resource permitting agency for banding recommendations/requirements) and have radio transmitters attached (as required). Mist-netting guidelines are contained in Appendix C.

If an Indiana bat(s) is captured during mist-netting, protocols for Phase 4- Radio-tracking and Emergence Surveys provided in Appendix D and E, respectively, must be followed. Radio-tracking and emergence surveys can provide vital data regarding roosting habitat and colony size. Emergence surveys should begin as soon as feasible after identification of a roost, preferably the same night.

If Indiana bats are not captured during mist-netting, coordinate with the local USFWS FO to determine which type of Indiana bat population (i.e., maternity colony or males) is likely to use the project site. If a maternity colony is assumed to be present, buffer positive acoustic survey sites by an assumed 5-mile (8-kilometer) radius home range. If positive acoustic results are obtained at sites located more than 5 miles apart, then multiple maternity colonies generally will be assumed present, but other factors will also be considered (e.g., spatial distribution of positive acoustic sites in conjunction with available summer habitat). Submit the results of all field work conducted for a project to the local USFWS FO(s) for review. The USFWS FO(s) will use this information in an analysis of effects (e.g., analysis of habitat quality or juxtaposition).

³ Due to concerns with transmission of white-nose syndrome, some USFWS FO(s) and state natural resource agencies have delayed the start of the Indiana bat summer field survey season/mist-netting until June 1. Surveyors/applicants should always coordinate with local USFWS FO(s) and state natural resource agencies before beginning surveys.

NOTIFICATION/COORDINATION:

All work must be conducted in accordance with applicable federal and state endangered species permits. Following this guidance will meet USFWS requirements; however, surveyors also need to ensure they meet all applicable state permitting and reporting requirements. Failure to follow the survey guidance, as written, may result in USFWS FO recommendations for additional survey effort.

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APPENDIX A PHASE 1 SUMMER HABITAT ASSESSMENTS

The information below is provided to assist applicants, consultants, and/or project proponents (hereinafter termed the “applicant”) in establishing whether summer surveys for Indiana bats should be conducted. As a reminder, the first step for determining presence of Indiana bats at a given site is to determine whether there is any existing occurrence data available for the vicinity of the project from the local USFWS FO. The applicant is responsible for developing and providing sufficient information as to whether potentially suitable summer Indiana bat habitat exists within a proposed project area (see attached Indiana Bat Habitat Assessment Datasheet). If suitable habitat is present, the applicant should calculate the amount present and submit this to the USFWS FO(s) with a proposed Phase 2 acoustic survey study plan. If no suitable habitat is present, no surveys are needed to assess risk during the summer. **Habitat assessments for Indiana bats can be completed any time of year and applicants are encouraged to submit results prior to the summer survey season.**

PERSONNEL

Habitat assessments should be completed by individuals with a natural resource degree or equivalent work experience.

DEFINITION FOR POTENTIALLY SUITABLE SUMMER HABITAT

Suitable summer habitat for Indiana bats consists of the variety of forested/wooded habitats where they roost, forage, and travel as well as surrounding non-forested habitats (e.g., agricultural fields, emergent wetlands, old fields, pasture). This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags greater than 3 inches dbh⁴ (7.6 centimeter) that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other suitable habitat.

SUBMISSION OF HABITAT ASSESSMENT AND PHASE 2 STUDY PLAN (IF NEEDED)

If a proposed project may affect (positively or negatively) Indiana bats, a habitat assessment report should be submitted to the appropriate USFWS FO(s) along with a draft study plan for the acoustic survey (if suitable habitat is present). Complete reports will include the following:

1. Full names and relevant titles/qualifications of individuals (e.g., John E. Smith, Biologist II, State University, B.S. Wildlife Science 2007) completing the habitat assessment and when the assessment was conducted

⁴ While any tree greater than 3 inches dbh (7.6 centimeters) with exfoliating bark, cracks, crevices, and/or hollows has the potential to be male Indiana bat summer roosting habitat, even-aged stands of 3-inch dbh and smaller trees are not defined as suitable roosting habitat for the purposes of this guidance. Suitable roosting habitat is defined as forest patches with trees of 5-inch dbh (12.7 centimeters) or larger, although trees as small as 3 inches within the forest patch(es) may also be included.

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2. A map and latitude/longitude or UTM clearly identifying the project location (or approximate center point) and boundaries
3. A detailed project description
4. Documentation of any known-occupied spring staging, summer, fall swarming, and/or winter habitat for Indiana bats within the project area
5. A description of methods used during the habitat assessment
6. A summary of the assessment findings and a completed Indiana Bat Habitat Assessment Datasheet (see attached below; use of this particular datasheet is optional)
7. Other information that may have a bearing on Indiana bat use of the project area (e.g., presence of fall or winter habitat [caves, crevices, fissures, or sinkholes, or abandoned mines of any kind], bridges and other non-tree potential summer roosts.)
8. Any other information requested by the local USFWS FO(s) related to the project
9. If a Phase 1- Habitat Assessment confirmed the presence of suitable Indiana bat habitat and an acoustic survey is planned, then submit a draft study plan for a Phase 2- Acoustic Survey to the USFWS FO(s) for review and approval. Phase 2 study plans should include a map/aerial photo identifying the proposed project area boundaries, suitable bat habitats and acreages within the project area, and the proposed number and tentative locations of acoustic monitoring sites (see Appendix B for level of effort).
10. Some federal and state permit holders⁵ are required by his or her permit to request and receive written authorization from the local USFWS FO(s) at least 15 days prior to initiation of proposed survey work. These requests should be submitted in conjunction with the draft study plan for acoustic surveys.

⁵ Federal permits are not required for individuals to complete Phase 1 Habitat Assessments.

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INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: _____ Date: _____

Township/Range/Section: _____

Lat Long/UTM/ Zone: _____ Surveyor: _____

| Brief Project Description |
|---------------------------|
| |

| Project Area | Total Acres | Forest Acres | | Open Acres |
|-----------------------------------|--------------------|--------------------------------------|-----------------------------|------------|
| Project | | | | |
| Proposed Tree Removal (ac) | Completely cleared | Partially cleared (will leave trees) | Preserve acres- no clearing | |
| | | | | |

| Vegetation Cover Types | |
|------------------------|--------------|
| Pre-Project | Post-Project |
| | |

| Landscape within 5 mile radius |
|---|
| Flight corridors to other forested areas? |
| Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources) |

| Proximity to Public Land |
|--|
| What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)? |

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Use additional sheets to assess discrete habitat types at multiple sites in a project area

*Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same*

| |
|--------------------------------|
| Sample Site Description |
| Sample Site No.(s): _____ |

| Water Resources at Sample Site | | | |
|---|------------------------------|--------------|-----------|
| Stream Type (# and length) | Ephemeral | Intermittent | Perennial |
| Pools/Ponds (# and size) | Open and accessible to bats? | | |
| Wetlands (approx. ac.) | Permanent | Seasonal | |
| Describe existing condition of water sources: | | | |

| Forest Resources at Sample Site | | | |
|---|----------------|-------------------|-------------------|
| Closure/Density | Canopy (> 50') | Midstory (20-50') | Understory (<20') |
| Dominant Species of Mature Trees | | | |
| % Trees w/ Exfoliating Bark | | | |
| Size Composition of Live Trees (%) | Small (3-8 in) | Med (9-15 in) | Large (>15 in) |
| No. of Suitable Snags | | | |

1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%,
5=61-80%, 6=81-100%

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? _____

| |
|-----------------------------|
| Additional Comments: |
|-----------------------------|

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX B PHASE 2 ACOUSTIC SURVEYS

SUMMER ACOUSTIC SURVEY SEASON: May 15 – August 15

PERSONNEL

Acoustic surveyors must have a working knowledge of the acoustic equipment, analysis tools, and Indiana bat ecology. Surveyors must be able to identify appropriate detector placement sites and establish those sites in the areas that are most suitable for recording high-quality Indiana bat calls. Thus, it is highly recommended that all potential acoustic surveyors attend appropriate training and have experience in the proper placement of their field equipment.

DETECTOR AND MICROPHONE REQUIRED CHARACTERISTICS

Full-spectrum and/or zero-crossing detectors are suitable for use in this survey protocol.

Directional microphones are the only microphone type accepted for acoustic surveys at this time.

ACOUSTIC SAMPLING PROTOCOL

Detector Placement

Detector placement is critical to the successful isolation of high-quality bat calls for later analysis. The following locations are likely to be suitable sites for detectors, including, but not limited to: (a) forest-canopy openings that are no more than 164 feet (50 meters) wide; (b) water sources; (c) wooded fence lines that are adjacent to large openings or connect two larger blocks of suitable habitat; (d) blocks of recently logged forest where some potential roost trees remain; (e) road and/or stream corridors with open tree canopies or canopy height of more than 33 feet (10 meters); and (f) woodland edges (Britzke et al. 2010). If detectors are placed in unsuitable locations, effective data analysis may be impossible, and the results of the sampling effort may be invalid.

Surveyors should deploy detectors/microphones in the following manner: (a) at least 5 feet (1.5 meters) in any direction from vegetation or other obstructions (Hayes 2000; Weller and Zabel 2002); (b) in areas without, or with minimal⁶, vegetation within 33 feet (10 meters) in front of the microphone; (c) orient detectors parallel when sampling woodland edges; (d) at least 49 feet (15 meters) from water surfaces (Johnson et al 2012); (e) at least 328 feet (100 meters) from artificial high-frequency emitters (e.g., wind turbines, high-tensile power-lines, and micro-wave towers) (Johnson et al 2012); and (f) at least 49 feet (15 meters) from known or suitable roosts⁷ (e.g., trees/snags, buildings, bridges, bat houses, cave or mine portal entrances).

⁶ If necessary, surveyors can remove small amounts of vegetation (e.g., small limbs, saplings) from the estimated detection cone at a site, much like what has been done while setting up mist-nets in the past. Deployment of detectors in closed-canopy locations that typically are good for mist-netting are acceptable as long as the area sampled below the canopy does not restrict the ability of the equipment's detection cone to record high-quality calls (i.e., the vegetation is outside of the detection cone).

⁷ If the surveyor discovers a potential roost and wishes to document bat use, please refer to Appendix E for guidance on conducting emergence surveys and contact the USFWS FO(s).

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Surveyors should distribute acoustic sites throughout the project area or adjacent habitats. In most cases, detector sites should be at least 656 feet (200 meters) apart. If closer spacing is determined to be necessary or beneficial (e.g., multiple suitable habitats and acoustic sites immediately adjacent to each other), sufficient justification must be provided in the acoustic survey report submitted to USFWS FO(s).

Verification of Deployment Location

It is recommended to temporarily attach GPS units to each detector (according to manufacturer's instructions) to directly record accurate location coordinates for each acoustic site that is paired with the acoustic data files. Regardless of technique used, accurate GPS coordinates must be generated and reported for each acoustic survey site.

Verification of Proper Functioning

It is highly recommended that surveyors ensure acoustic detectors are functioning properly through a periodic verification of performance to factory specifications (a service currently offered or in development by several manufacturers). It may be possible that independent service bureaus would be willing to perform this service, providing that a standard test/adjustment procedure can be developed.

It is also recommended to ensure equipment is working during set-up in the field. This can be done simply by producing ultrasound (e.g., finger rubs) in front of the microphone at survey start and survey finish. This documents that the equipment was working when deployed and when picked up (and by assumption throughout the entire period). Many types of detectors allow for setting timers that initiate and end recording sessions. This saves battery life as well as reducing the number of extraneous noise files recorded. However, if the units are visited when the timer is off, the surveyor cannot verify that the unit is functioning properly. This is particularly important in areas where no bat activity is recorded for the entire night or during the last portion of the night. In these cases, if the surveyor cannot demonstrate that the detector was indeed functioning properly throughout the survey period, then the site will need to be re-sampled, unless adequate justification can be provided to the USFWS FO(s).

Suitability of the selected acoustic survey sites will also be assessed in the data-analysis stage. Suitable set-up of the equipment should result in high-quality calls that are adequate for species identification. Thus, at least 10 bat calls (i.e., greater than or equal to 3 high-quality pulses in a call) must be recorded AND a minimum of 40% of all recorded bat calls must be identified to the species level for each detector on each survey night for the site to be deemed suitable. Nights of sampling at individual sites that do not meet these minimum requirements will need to be re-sampled unless adequate justification can be provided to the USFWS FO(s). Modifications of the equipment (e.g., changing the orientation) at the same location on subsequent nights may improve quantity and quality of calls recorded, which can be determined through daily data downloads. If modifications of the equipment do not improve call identification, then the detectors will need to be moved to a new location.

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Orientation

Detectors should be aimed 45 degrees or more above horizontal. In some circumstances (e.g., forest openings), it might be desirable to aim the detector vertically. This has shown to record high quality calls but precludes the use of weatherproofing for protection of the microphone, since no currently-approved weatherproofing system will adequately protect the microphone of a detector aimed vertically.

Deploy detectors at or below the lowest expected flight height of the bats but high enough above ground vegetation to avoid interference within the detection cone. Once acoustic sites are identified, photographs documenting the orientation, detection cone (i.e., “what the detector is sampling”), and relative position of the microphone should be taken for later submittal to the USFWS FO(s) as part of the acoustic survey report.

Weather Conditions

If any of the following weather conditions exist at a survey site during acoustic sampling, note the time and duration of such conditions, and repeat the acoustic sampling effort for that night: (a) temperatures fall below 50°F (10°C) during the first 5 hours of survey period; (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the first 5 hours of the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale) during the first 5 hours of the survey period. At a minimum, nightly weather conditions for survey sites should be checked using the nearest NOAA National Weather Service station and summarized in the survey reports.

Weatherproofing

Most bat detectors are not weatherproof when delivered from the factory. Recording without after-market weatherproofing is preferred as the addition of these systems may result in some signal degradation.

For directional microphones, the use of a polyvinyl chloride (PVC) tube, generally in the form of a 45-degree elbow the same diameter as the microphone (Britzke et al. 2010) is acceptable, if the situation requires the use of after-market weatherproofing. Attach the elbow to a weatherproof box that houses the main portion of the detector. Point the microphone into one end of the elbow and point the open end of the elbow in the direction to be monitored (generally 45 degrees to horizontal). Another option for weatherproofing detectors is to detach the microphone from the detector so that the detector can be placed in a weatherproof container but the microphone (tethered by a cable) remains unobstructed.

Other after-market weatherproofing systems may become available and approved by the Service provided they show that call quality and the number of calls recorded are comparable to those without weatherproofing.

MINIMUM LEVEL OF EFFORT

The number of acoustic survey sites required for a project will be dependent upon the overall acreage of suitable habitat proposed to be impacted by the action. To determine the acoustic

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survey effort, quantify the amount of suitable habitat within the project area. Using detection probabilities as determined in post-white-nose syndrome (WNS) environments as the baseline necessary to document Indiana bats, all projects will require (1) a minimum of two acoustic survey sites, (2) the deployment of a minimum of one detector per survey site, and (3) all sampling to be conducted for at least six suitable nights. To reduce the survey duration, additional detectors may be added at individual survey sites accordingly: 5 nights for 2 detectors per site, 4 nights for 3 detectors per site, and 3 nights for 4 detectors per site (MacKenzie and Royle 2005). The acoustic sampling period for each site must begin before sunset⁸ and continue throughout the entire night (i.e., until after sunrise) for each night of sampling.

- For non-linear projects: one site per 30 acres (12 hectares) of suitable habitat
- For linear projects up to 328 feet (100 meters) wide: one site for each 0.6 mile (1 kilometer) of the project corridor that contains suitable habitat.

ANALYSIS OF RECORDED ECHOLOCATION CALLS

The analysis of acoustic calls recorded under this guidance must be conducted with a USFWS-approved call identification software program. A list of approved programs will be available on the USFWS's website at:

<http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html>

Interpretation of Acoustic Analysis Results

If the acoustic analysis results in the identification of Indiana bat calls with high levels of certainty (e.g., a maximum likelihood result of $P < 0.10$), then the project proponent should mist-net in an attempt to capture recorded bats, although instead, the option to assume the presence of a maternity colony exists. Additional survey work should follow the mist-netting guidance found in Appendix C. While mist-netting is encouraged immediately after acoustic surveys are completed, additional survey work to capture and radio track Indiana bats can occur at any time within the mist-netting survey window.

Additionally, if the data analysis of collected calls results in the identification of other federally endangered bat species (e.g., gray bats, *Myotis grisescens*), then the USFWS FO(s) in the state(s) where calls were detected should be notified immediately to determine if any additional survey effort for those species is necessary.

SUBMISSION OF ACOUSTIC SURVEY RESULTS

If acoustic surveys document the presence of Indiana bats, then the appropriate USFWS FO(s) must be notified within 48 hours by providing the project name, date, and GPS location(s) of positive detection. A complete acoustic survey report documenting the presence and/or absence of Indiana bats must be submitted to the appropriate USFWS FO(s) for review and concurrence at the conclusion of all project-specific summer survey field work discussed in this guidance

⁸ Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php

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document. If acoustic surveys do not indicate the presence of Indiana bats, no further sampling is needed. Each acoustic survey report must include the following:

1. Copy of habitat assessment and acoustic survey study plan report (if not previously provided)
2. Explanation of any modifications from study plan (e.g., altered site locations)
3. Description of acoustic monitoring sites, survey dates, duration of survey, weather conditions, and a summary of findings
4. Map identifying acoustic monitoring locations and a corresponding table including the GPS coordinates
5. Full names of all personnel conducting acoustic surveys, including those that selected acoustic sites and deployed detectors, and include copies of state and federal permits (if applicable)
6. Table with information on acoustic monitoring and resulting data, including but not limited to: acoustic detector brand(s) and model(s) used, microphone type, use of weatherproofing, acoustic monitoring equipment settings (e.g., sensitivity, audio and data division ratios), deployment data (i.e., deployment site, habitat, date, time started, time stopped, orientation), and automated acoustic identification program used
7. Acoustic analysis software program output/summary results by site (i.e., number of calls detected, species composition)
8. Photographs of each acoustic site documenting the location of the detector, the orientation of the detector, and the detection cone (i.e., what the detector sampled)
9. A description of how proper functioning of bat detectors was verified
10. Any other information requested by the local USFWS FO(s) related to the project
11. If an acoustic survey resulted in the documentation of Indiana bats and the project proponent has elected to continue with mist-netting surveys, then provide a draft Phase 3 & 4 mist-netting, radio-tracking, and emergence survey study plan for USFWS FO(s).

REFERENCES

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Johnson, Joshua B., Ford, W. Mark, Rodrigue, Jane L., Edwards, John W. 2012. Effects of acoustic deterrents on foraging bats. Res. Note NRS-129. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p.

MacKenzie, D.I., and J.A Royle. 2005. Designing occupancy studies: general advice and allocating survey effort. *Journal of Applied Ecology* 42:1105-1114.

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APPENDIX C PHASE 3 MIST-NETTING

SUMMER MIST-NETTING SEASON: May 15⁹ – August 15

Capture of reproductive adult females (i.e., pregnant, lactating, or post-lactating) and/or young of the year during May 15 – August 15 confirms the presence of a maternity colony in the area. (Since adult males and non-reproductive females have commonly been found summering with maternity colonies, radio-tracking results will be relied upon to determine the presence or absence of a maternity colony or large concentrations of bats in the area when males and/or non-reproductive females are captured.)

PERSONNEL

A qualified biologist(s)¹⁰ must (1) select/approve mist-net set-ups in areas that are most suitable for capturing Indiana bats, (2) be physically present at each mist-net set-up throughout the survey period, and (3) confirm all bat species identifications. This biologist may manage more than one mist-net set-up if the net-check timing (i.e., every 10 minutes) can be maintained while **walking** between nets (which is similar to managing two net set-ups at one net site in past guidance).

EQUIPMENT

Use the finest, lowest visibility mesh mist-nets commercially available, as practicable. Currently, the finest net on the market is 75 denier, 2 ply, denoted 75/2 (Arndt and Schaez 2009); however, the 50 denier nets are still acceptable for use at this time. The finest mesh size available is approximately 1½ inches (38 millimeters).

No specific hardware is required. There are many suitable systems of ropes and/or poles to hold nets. The system of Gardner et al. (1989) has been widely used. See NET PLACEMENT for minimum net heights, habitats, and other netting requirements that affect the choice of hardware.

To minimize potential for disease transmission, any equipment that comes in contact with bats must be kept clean and disinfected, following approved protocols; this is particularly a concern relative to white-nose syndrome (WNS). Disinfection of equipment to avoid disease transmission (e.g., WNS) is required; protocols are posted at <http://www.whitenosesyndrome.org/>. Federal and state permits may also have specific equipment restrictions and disinfection requirements.

⁹ Due to concerns with transmission of white-nose syndrome, some USFWS FO(s) and state natural resource agencies have delayed the start of the Indiana bat summer field survey season/mist-netting until June 1. Surveyors/applicants should always coordinate with local USFWS FO(s) and state natural resource agencies before beginning surveys.

¹⁰ A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for federally-listed bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to mist-net for Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

APPENDIX C
PHASE 3 MIST-NETTING

MINIMUM MIST-NETTING EFFORT

The following guidelines are the minimum-suggested level of effort to give surveyors a reasonable chance of capturing Indiana bats previously documented by acoustic surveys. Surveyors may increase the level of effort, as needed.

To determine the suggested minimum mist-netting effort for each individual project (linear or non-linear), complete the following steps (also see Figures 1 and 2 for examples of small and large projects, respectively):

1. For projects with one positive acoustic site for Indiana bats, place a 1-mile (1.6-kilometer) radius buffer circle around the positive site, then continue to Step 3.a.
2. For projects with multiple positive acoustic sites documenting Indiana bats:
 - a. Identify the two positive acoustic sites that are in the closest proximity to each other.
 - b. If those sites are within 1 mile (1.6 kilometer) of each other, then identify the midpoint of the line connecting the two sites. Place a 1-mile radius buffer circle around the midpoint and identify the total number of positive acoustic sites within that buffer circle. Once positive acoustic sites are included within a buffer circle, they will not be considered during the creation of any remaining buffer circles.
 - c. If the sites are greater than 1 mile (1.6 kilometer) from each other, place a 1-mile radius buffer circle around each positive site.
 - d. Continue this process until all sites are placed in a buffer circle and proceed to Step 3.
3. For each buffer circle identified, mist-netting, distributed throughout suitable habitat near positive acoustic sites, should be conducted using the following schedule (overlapping buffer circles do not affect the minimum number of net nights recommended):
 - a. 1 positive acoustic site within a buffer circle = 10 net nights¹¹
 - b. 2 positive acoustic sites within a buffer circle = 14 net nights
 - c. 3 positive acoustic sites within a buffer circle = 18 net nights
 - d. 4+ positive acoustic sites within a buffer circle = 20 net nights

The USFWS FO responsible for the state in which the project occurs should be consulted during survey design to resolve project-specific issues related to mist-netting.

¹¹ A “net night” is defined as 1 location surveyed using 1 mist-net set-up for a single night.

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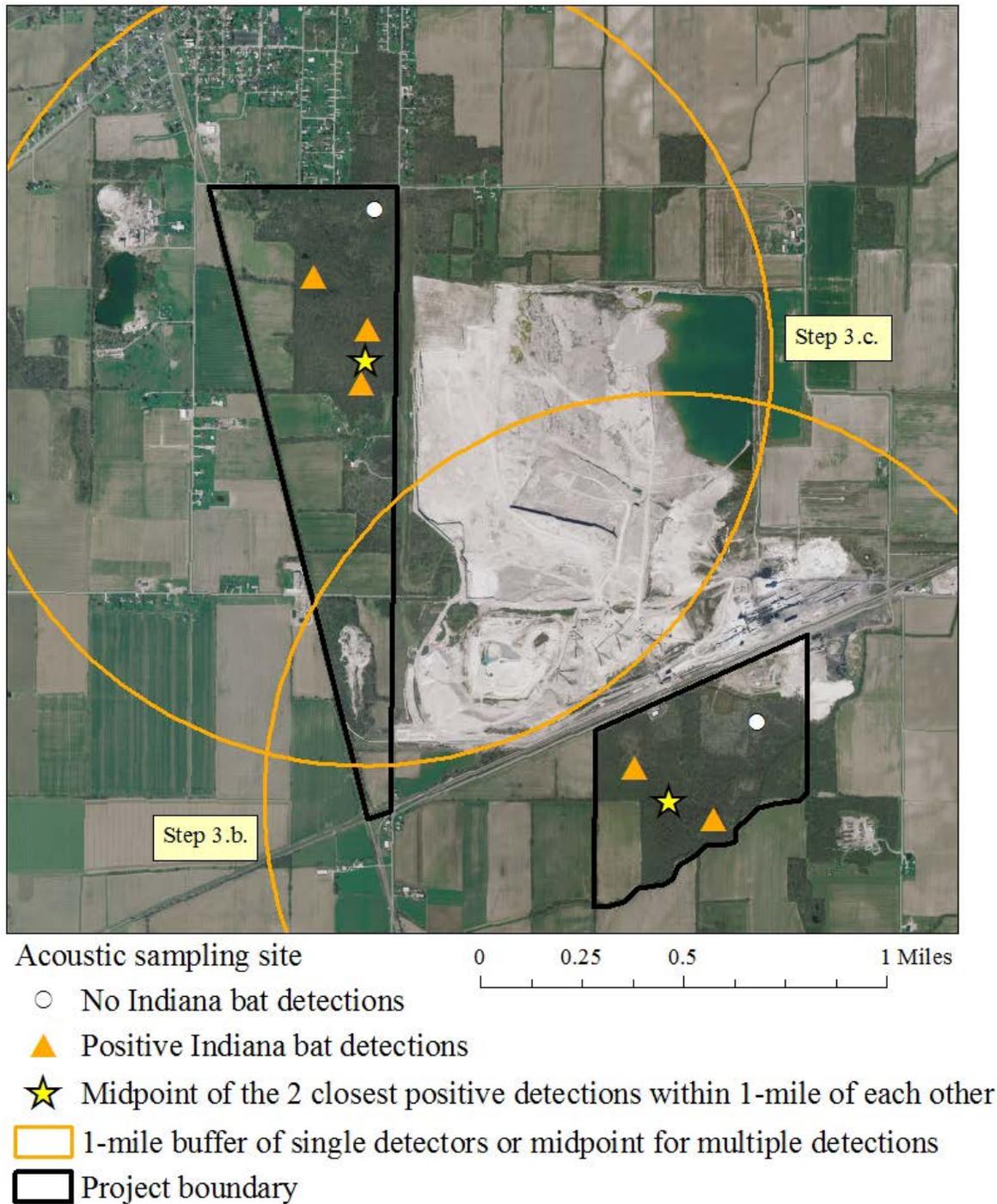
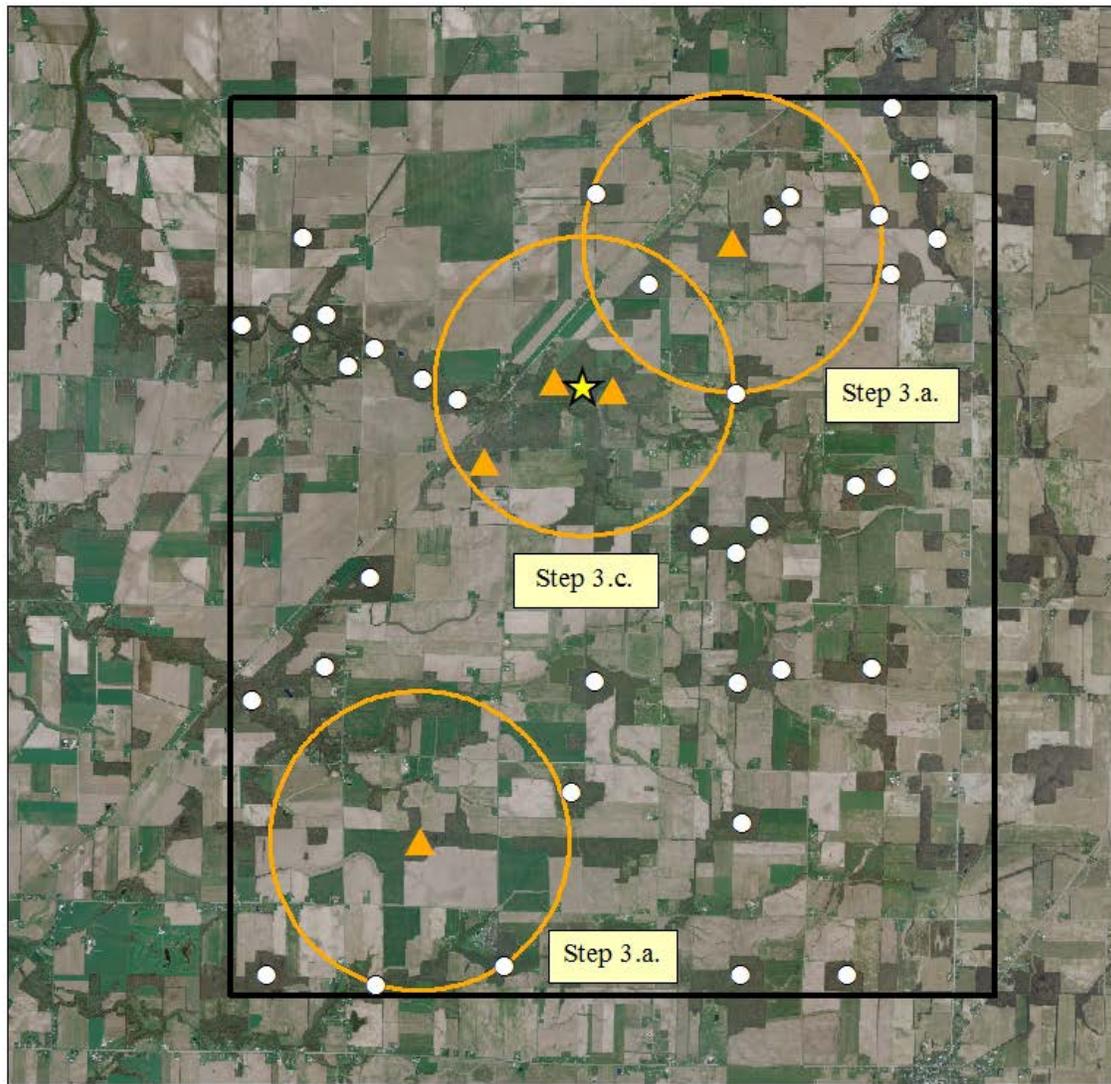


Figure 1. An example of a small project area depicting positive and negative results at Phase 2 acoustic survey sites and 1-mile (1.6-kilometer) buffers used for establishing an appropriate number of Phase 3 mist-net locations. Using the suggested minimum mist-netting effort described in this guidance, at least 32 net nights would be sampled in this example.

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- Acoustic sampling site
- No Indiana bat detections
- ▲ Positive Indiana bat detections
- ★ Midpoint of the 2 closest positive detections within 1-mile of each other
- 1-mile buffer of single detectors or midpoint for multiple detections
- ▭ Project boundary
- 0 0.5 1 2 3 Miles

Figure 2. An example of a large project area depicting positive and negative results at Phase 2 acoustic survey sites and 1-mile (1.6- kilometer) buffers used for establishing an appropriate number of Phase 3 mist-net locations. Using the suggested minimum mist-netting effort described in this guidance, at least 38 net nights would be sampled in this example.

APPENDIX C PHASE 3 MIST-NETTING

NET PLACEMENT

Under these guidelines, mist-netting is a focused effort to capture Indiana bats that were detected during the Phase 2- Acoustic Surveys and captures will help to better understand Indiana bat use of a project area. Thus, mist-net set-ups should be as near to positive acoustic detection sites for Indiana bats as possible, as well as in suitable habitat.

Potential travel corridors (e.g., streams, logging trails) typically are the most effective places to net (although other places may also be productive; see Carroll et al. 2002). Place nets approximately perpendicular across the corridor. Nets should fill the corridor from side to side and from stream (or ground) level up to the overhanging canopy. Nets of varying widths and heights may be used as the situation dictates. If netting over water, ensure there is enough space between the net and the water so that the bat will not get wet upon capture.

Occasionally it may be necessary or desirable to net where a suitable corridor is lacking. The typical equipment described in the section above may be inadequate for these situations, requiring innovation on the part of the surveyor (see Humphrey et al. 1968). See Kiser and MacGregor (2005) for additional discussion about net placement.

Although no minimum spacing between mist-nets is being specified, surveyors should distribute net set-ups throughout suitable habitat. Net set-ups can be repeatedly sampled throughout the project, but generally no more than two nights at a single location is recommended. In addition, changing locations within a project area may improve capture success (see Robbins et al. 2008; Winhold and Kurta 2008). Photo-document placement of nets.

SURVEY PERIOD

The survey period should begin at sunset¹² and continue for at least 6 hours (longer survey periods may also improve success).

CHECKING NETS

Each net set-up should be checked approximately every 10 minutes, never exceeding 15 minutes (Gannon et al. 2007). If surveyors monitor continuously, take care to avoid noise and movement near the nets. Monitoring the net set-up continuously with a bat detector can be beneficial: (a) bats can be detected immediately when they are captured, (b) prompt removal from the net decreases stress on the bat and potential for the bat to escape (MacCarthy et al. 2006), and (c) monitoring with a bat detector also allows the biologist to assess the effectiveness of each net placement (i.e., if bats are active near the net set-up but avoiding capture), which may allow for adjustments that will increase netting success on subsequent nights. There should be no other disturbance near the nets, other than to check nets and remove bats. Biologists should be prepared to cut the net if a bat is severely entangled and cannot be safely extracted within 3 or 4 minutes (CCAC 2003; Kunz et al. 2009).

¹² Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php.

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Capture and handling are stressful for bats. Emphasis should be on minimizing handling and holding bats to as short a time as possible to achieve field study objectives. Indiana bats should not be held for more than 30 minutes after capture, unless the individual is targeted for radio-tracking. Bats targeted for radio-tracking should be released as quickly as possible, but no longer than 45 minutes after capture, or as allowed in federal and state permits. See Kunz and Kurta (1988) for general recommendations for holding bats.

WEATHER AND LIGHT CONDITIONS

Surveyors should conduct additional mist-netting if any of the following weather conditions are experienced throughout all or most of a sampling period: (a) temperatures that fall below 50°F (10°C); (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/seconds; 3 on Beaufort scale).

It is typically best to place net set-ups under the canopy where they are out of moonlight, particularly when the moon is half-full or greater. Net set-ups illuminated by artificial light sources should also be avoided.

DOCUMENTATION OF *MYOTIS SODALIS* CAPTURES

If an Indiana bat(s) is captured during mist-netting, protocols for radio-tracking and emergence survey requirements, as provided in Appendix D and E, respectively, must be followed. In addition, the appropriate USFWS FO(s) must be notified of the capture within 48 hours, and the sex and reproductive condition of the bat and GPS coordinates of the capture site should be provided.

Several species of bats from the genus *Myotis* share common features which can make identification difficult; Indiana bats and little brown bats (*Myotis lucifugus*) can be particularly difficult to distinguish. Photo-documentation of all bats captured and identified as Indiana bats and the first 10 little brown bats per project are required to verify the identifications made in the field.

Photo-documentation should include diagnostic characteristics:

- a ¾-view of face showing ear, tragus, and muzzle
- a ventral view of calcar showing presence/absence of keel
- a transverse view of toes showing extent of toe hairs

SUBMISSION OF MIST-NETTING RESULTS

A Phase 3 mist-netting report must be submitted to the appropriate USFWS FO(s) for review and approval. If Indiana bats are captured, this report should also include the data submission requirements of the subsequent radio-tracking and emergence count efforts. Each mist-netting report must include the following:

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PHASE 3 MIST-NETTING

1. Copy of Phase 1- Summer Habitat Assessment, Phase 2 acoustic survey report and Phase 3 and 4 mist-netting/radio-tracking/emergence count survey study plan (if not previously provided).
2. Description and justification of any modifications from the Phase 3 and 4 mist-netting/radio-tracking/emergence count study plan (e.g., altered net locations).
3. Description of net locations (including site diagrams), net set-ups (include net heights), survey dates, duration of surveys, weather conditions, and a summary of findings.
4. Map identifying netting locations and information regarding net set-ups, including lat/long or UTM, individual net placement, and net spacing (i.e., include mist-netting equipment in photographs of net locations).
5. Full names of mist-netting personnel attending each mist-net set-up during an operation, including the federally-permitted/qualified biologist present at each mist-net set-up. Indicate on the field data sheet the full name of person who identified bats each night at each set-up.
6. Legible copies of all original mist-netting datasheets (see example datasheet below) and a summary table with information on all bats captured during the survey including, but not limited to: capture site, height of capture in net, date of capture, time of capture, sex, reproductive condition, age, weight, right forearm measurement, band number and type (if applicable), and Reichard's wing damage index score (available at: http://www.fws.gov/northeast/PDF/Reichard_Scarring%20index%20bat%20wing%20s.pdf).
7. Photographs of all net set-ups, as well as **all** Indiana bats and the first 10 little brown bats captured from each project, so that the placement of netting equipment and identification of species can be verified. Photographs of bats should include all diagnostic characteristics that resulted in the identification of the bat to the species level.
8. Any other information requested by the local USFWS FO(s) related to the project
9. Copy of the site-specific written authorization from USFWS and/or state natural resource agency (if required)

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APPENDIX C
PHASE 3 MIST-NETTING

Sample Data Sheets for Indiana Bat Surveys

| Site No. | | | | Project/Firm: | | | | Date: | | | | | | |
|-----------------|------|---------|-----|---------------|---------------|----------|----------|------------|------------|------------|-------------|---------------------------|-----------------------------|-----|
| Location: | | | | | | | | | | | | | | |
| County: | | | | State: | | Quad: | | Quadrant: | | | | | | |
| Lat/Long (DMS): | | N | | W | | Zone: | | Surveyors: | | | | | | |
| # | Time | Species | Age | Sex | Repro. Cond.* | RFA (mm) | Mass (g) | Net/Ht | Guano/Hair | Wing Score | Band # Type | Moon Phase: | | % |
| 1 | | | | | | | | | | | | | Rise | Set |
| 2 | | | | | | | | | | | | | Moon: | |
| 3 | | | | | | | | | | | | | Sun: | |
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| | | | | | | | | | | | | Avg | | |
| | | | | | | | | | | | | Sky Code | | |
| | | | | | | | | | | | | 0 | Clear | |
| | | | | | | | | | | | | 1 | Few Clouds | |
| | | | | | | | | | | | | 2 | Partly Cloudy | |
| | | | | | | | | | | | | 3 | Cloudy or overcast | |
| | | | | | | | | | | | | 4 | Smoke or fog | |
| | | | | | | | | | | | | 5 | Drizzle or light rain | |
| | | | | | | | | | | | | 6 | Thunderstorm | |
| | | | | | | | | | | | | Beauford Wind Code | | |
| | | | | | | | | | | | | 0 | Calm (0 mph) | |
| | | | | | | | | | | | | 1 | Light wind (1-3 mph) | |
| | | | | | | | | | | | | 2 | Light breeze (4-7 mph) | |
| | | | | | | | | | | | | 3 | Gentle breeze (8-12 mph) | |
| | | | | | | | | | | | | 4 | Moderate breeze (13-18 mph) | |

*Repro. Cond (Reproductive Condition): (P) pregnant; (L) lactating; (PL) post-lactating; (NR) non-reproductive, (TD) testes descended

APPENDIX D PHASE 4 RADIO-TRACKING

PERSONNEL

A qualified biologist¹³ who is experienced in handling Indiana bats and attaching radio transmitters must perform transmitter attachments, as further explained in the protocol below.

METHODS

If one or more Indiana bats are captured, the following radio-tracking protocols will be applicable:

1. Radio transmitters shall be attached to all¹⁴ female, juvenile, and adult male¹⁵ (greater than or equal to 0.2 ounces/6.0 grams) Indiana bats captured (a maximum of 5 individuals per potential colony), unless restricted by state regulations. Since the maximum holding times for Indiana bats targeted for radio-tracking is 45 minutes, or as allowed in federal and state permits, surveyors should be prepared to place transmitters on bats immediately following their capture to minimize holding times. Biologists should carry a minimum of 5 transmitters with them for each project area, unless the size of the project area could encompass more than one maternity colony home range (i.e., 5-mile [8-kilometer] buffered area from center of project). These large-scale projects would require biologists to have a minimum of 5 transmitters per potential colony.
2. The radio transmitter, adhesive, and any other markings (e.g., wing bands) should ideally weigh less than 5% of pre-attachment body weight but must not weigh more than 10% of a bat's total body weight (Kurta and Murray 2002). In all cases, the lightest transmitters capable of the required task should be used, particularly with pregnant females and volant juveniles. With pregnant bats, biologists should always use the lightest transmitter possible but no more than 5% of their expected non-pregnant weight. Proposed radio telemetry equipment (e.g., receivers, antennas, and transmitters) and frequencies should be coordinated with the appropriate state natural resource agency and USFWS FO(s).
3. The qualified biologist or biological technician(s) should track all radio-tagged bats captured to diurnal roosts for at least 7 days and must conduct a minimum of 2 evening emergence counts at each identified roost (See Appendix F for Emergence Survey Protocols). However, biologists are encouraged to continue radio-tracking efforts voluntarily until the transmitter fails, fall off, or cannot be located. Biologists should

¹³ A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for federally-listed bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to mist-net for Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

¹⁴ Biologists should coordinate in advance with USFWS FO(s) regarding recommendations for distribution of transmitters (e.g., prioritization of sex/age, maximum number per site, etc.) and whether foraging data would be beneficial to collect. Also, professional judgment should be used to determine whether attachment of transmitters could compromise the health of a bat.

¹⁵ Please consult with the USFWS FO in the state in which mist-netting will occur in advance to determine if tracking of adult males is necessary, and if so, what the project-specific protocol will be.

APPENDIX D
PHASE 4 RADIO-TRACKING

contact the USFWS FO(s) immediately if they suspect a transmitter has failed or fallen off before the 7-day tracking period ends. In all cases, landowners should be contacted and grant access to roosts prior to conducting these activities. If access is denied, approximate roost locations (i.e., coordinates) should be determined using triangulation. Surveyors should never trespass during radio-tracking.

4. Daily radio telemetry searches for roosts must be conducted during daylight hours and must be conducted until the bat(s) is located or for a minimum of 4 hours of ground or 1 hour of aerial-searching effort per tagged bat per day for 7 days. However, multiple bats captured at the same net location or nearby may be tracked simultaneously. Once a signal is detected, tracking should continue until the roost is located. At a minimum, biologists must document all ground and aerial-searching effort for all bats not recovered during radio-tracking for submittal with the survey report. For each roost identified during tracking, the biologist should complete a “USFWS Indiana Bat Roost Datasheet” (Appendix D).
5. To minimize potential for disease transmission, any equipment that comes in contact with bats must be kept clean and disinfected, following approved protocols; this is particularly a concern relative to white-nose syndrome (WNS). Disinfection of equipment to avoid disease transmission (e.g., WNS) is required; protocols are posted at <http://www.whitenosesyndrome.org/>. Federal and state permits may also have specific equipment restrictions and disinfection requirements.

SUBMISSION OF RADIO-TRACKING RESULTS

Phase 4 radio-tracking results should be included with the Phase 3 mist-netting report and must be submitted to the appropriate USFWS FO(s) for review and approval. Each report must include the following information related to radio-tracking efforts:

1. Copy of Phase 1 habitat assessment, Phase 2 acoustic survey report, and Phase 3 and 4 mist-netting/radio-tracking/emergence count survey study plan (if not previously provided)
2. Description and justification of any modifications from the Phase 3 and 4 mist-netting/radio-tracking/emergence count study plan (e.g., number of transmitters used, frequency of transmitters changed)
3. Map and narrative detailing all ground and aerial searching effort for all bats not recovered during radio-tracking and relative to the negotiated or agreed effort as determined by the appropriate USFWS FO(s)
4. Map summarizing Indiana bat data collected from summer surveys for the proposed project (e.g., project area boundary and results from the site habitat assessment, acoustic survey, mist-net survey, radio-tracking, and emergence surveys)
5. Full names and permit numbers of personnel who attached transmitters to Indiana bats and full names of all personnel conducting radio-tracking efforts
6. Photographs of all roosts identified during radio-tracking

APPENDIX D
PHASE 4 RADIO-TRACKING

7. Legible copies of all original USFWS Indiana Bat Roost Datasheets
8. Any other information requested by the local USFWS FO(s) where work was conducted
9. Copy of the pre-approved site-specific written authorization from USFWS and/or state natural resource agency (if required)

REFERENCES

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PHASE 4 RADIO-TRACKING

USFWS INDIANA BAT ROOST DATASHEET

Biologists (Full Name): _____ Date: _____

UTM: Zone _____ Easting _____ Northing _____ OR

LAT _____ LONG _____

Property Owner: _____ Phone# _____

State _____ County _____ Site # _____

Roost # _____ Roost Name: _____

Roost Tree Data

Species: _____ Live ___ Snag ___ Other ___

(if other, explain) _____

DBH (in or cm) _____ Total Height (ft or m) _____

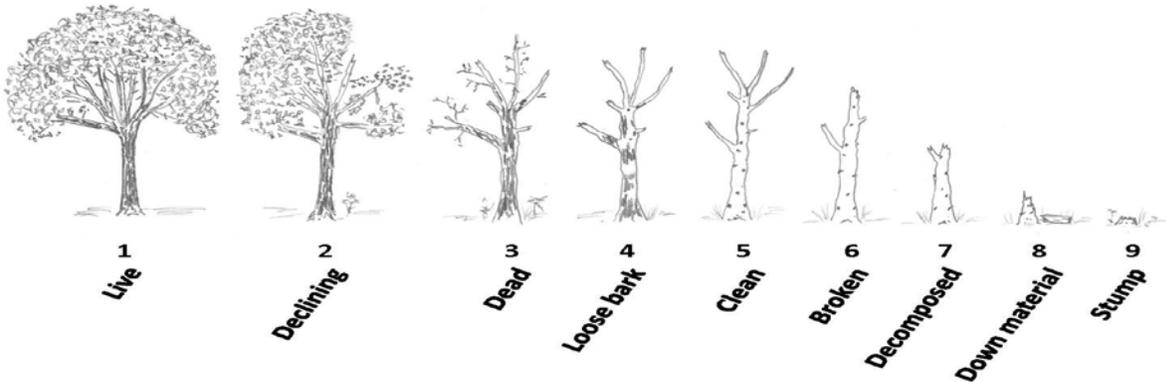
Height of roost area (if known) _____ Dist. from capture site _____

Roost position aspect (deg) _____

Exfoliating bark on bole (%) _____ Describe: sloughing ___ platy ___ tight ___

Cavities present? ___ If so, describe: _____

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



APPENDIX E
PHASE 4 EMERGENCE SURVEYS

PERSONNEL

Biological technicians and/or a qualified biologist¹⁶ who is experienced in conducting emergence surveys for Indiana bats must be present and actively involved in all emergence surveys for Indiana bats as further explained in the protocol below.

EMERGENCE SURVEYS FOR KNOWN INDIANA BAT ROOSTS

The following protocols should begin as soon as feasible after identification of a diurnal roost (ideally that night):

1. Bat emergence surveys should begin one half hour before sunset¹⁷ and continue until at least one hour after sunset or until it is otherwise too dark to see emerging bats. The surveyor(s) should be positioned so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be made at approximately 2-minute intervals. There should be at least one surveyor per roost. Surveyors must be close enough to the roost to observe all exiting bats but not close enough to influence emergence. That is, do not stand directly beneath the roost, do not make noise or carry on a conversation, and minimize use of lights (use a small flashlight or similar to record data, if necessary). Do not shine a light on the roost as this may prevent or delay bats from emerging. Use of an infra-red, night vision, or thermal-imaging video camera or spotting scope is encouraged but not required. Likewise, use of an ultrasonic bat detector may aid in identifying the exact timing of bats emerging, and therefore, is strongly recommended. If multiple roosts are known within a colony, then simultaneous emergence surveys are encouraged to estimate population size. [Note: If a roost cannot be adequately silhouetted, then the local USFWS FO(s) should be contacted to discuss alternative survey methods].
2. Bat activity is affected by weather; therefore emergence surveys should not be conducted when the following conditions exist: (a) temperatures that fall below 50°F (10°C); (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale).
3. Surveyors should use the attached “Bat Emergence Survey Datasheet”.
4. Surveyors should also complete an “Indiana Bat Roost Datasheet” for each roost known to be used by one or more Indiana bats (Appendix D).

¹⁶ A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for federally-listed bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to mist-net for Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

¹⁷ Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php

APPENDIX E
PHASE 4 EMERGENCY SURVEYS

5. Completed datasheets should be maintained in project files and included in reports prepared for the USFWS.

EMERGENCY SURVEYS FOR POTENTIAL INDIANA BAT ROOSTS

In some limited cases (e.g., individual hazard trees), surveyors may have the option of conducting emergency surveys for individual potential Indiana bat roosts to determine use prior to removal. The following protocol applies to these surveys:

1. Consult with the local USFWS Field Office(s) to determine whether a tree(s) that needs to be felled/ cleared may be potential roosting habitat for Indiana bats and whether conducting an emergency survey is an appropriate means of avoiding take of Indiana bats. In general, the USFWS only approves of conducting emergency surveys as a means of avoiding direct take of bats for projects that only affect a very small number of potential roosts (e.g., less than or equal to 10). An online directory of USFWS offices is available at: <http://www.fws.gov/offices/directory/listofficemap.html>.
2. If the USFWS FO(s) approves/concurs with Step 1, then follow the emergency guidelines for Emergency Surveys for Known Indiana Bat Roosts (above) to determine if any bats are roosting in the tree(s).
3. At the conclusion of the emergency survey:
 - a. If **no** bats were observed emerging from the potential roost(s), then it should be felled immediately. If safety concerns dictate that a tree cannot be felled immediately (i.e., in the dark), then the tree(s) should be felled as soon as possible after sunrise on the following day. If a tree is not felled during the daytime immediately following an emergency survey, then the survey has to be repeated, because bats may switch roosts on a nightly basis. Immediately after the tree is felled, a visual inspection of the downed tree must be completed to ensure that no bats were present, injured, or killed. The USFWS FO(s) should be contacted immediately, if bats are discovered during this inspection.
 - b. If **1 or more** bats (regardless of species, because species identification cannot reliably be made during visual emergency counts) are observed emerging from the roost, then it should **not** be felled, and the USFWS FO(s) should be contacted the next working day for further guidance.

SUBMISSION OF EMERGENCY SURVEY RESULTS

Emergency survey results should be included with the mist-netting survey report, unless the survey was completed as an evaluation of potential roosts, and must be submitted to the appropriate USFWS FO(s) for review. Each survey report must include the following information related to emergency survey efforts:

APPENDIX E
PHASE 4 EMERGENCE SURVEYS

1. Copy of Phase 1 habitat assessment, Phase 2 acoustic survey report, and Phase 3 and 4 mist-netting/radio-tracking/emergence count survey study plans (if not previously provided)
2. Explanation of any modifications from the Phase 3 and 4 mist-netting/radio-tracking/ emergence count study plan (e.g., number of potential roosts surveyed), if applicable
3. Summary of roost emergence data
4. Map identifying location of roost(s) identified during radio-tracking and/or emergence surveys for Indiana bat(s) including GPS coordinates
5. Full names of personnel present during emergence survey efforts and who conducted emergence surveys of roosts
6. Photographs of each identified roost
7. Copies of all “Emergence Survey” and “Indiana Bat Roost” datasheets
8. Any other information requested by the local USFWS FO(s) where work was conducted
9. Copy of the pre-approved site-specific written authorization from USFWS and/or state natural resource agency (if required)

APPENDIX E
PHASE 4 EMERGENCE SURVEYS

Site Name/#: _____ Roost Name/#: _____

| Time | Number of Bats Leaving Roost* | Comments / Notes |
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| Total Number of Bats Observed Emerging from the Roost/Feature During the Survey: | | |

* If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. If a radio-tagged bat was roosting in the tree, at what time did it emerge?
