APPENDIX 5: Indiana Bat Mist-Netting Guidelines

RATIONALE

A typical mist-net survey is an attempt to determine presence or probable absence of the species; it does not provide sufficient data to determine population size or structure. Following these guidelines will standardize procedures for mist netting. It will help maximize the potential for capture of Indiana bats at a minimum acceptable level of effort. Although capture of bats confirms their presence, failure to catch bats does not absolutely confirm their absence. Netting effort as extensive as outlined below usually is sufficient to capture Indiana bats if they are present. However, there have been instances in which additional effort yielded detection when the standard effort did not.

Some mist-netting projects will require modification (or clarification) of these guidelines; these situations must be resolved through coordination with the Service Field Office responsible for the state in which your project occurs. Consultation with the Field Office is always recommended, particularly for large-scale netting efforts.

The Service accepts the results of these surveys to determine presence for the purposes of Section 7 consultation. Survey results are valid for at least two years.

NETTING SEASON: May 15 - August 15

May 15-August 15 are acceptable limits for documenting the presence of summer populations of Indiana bats, especially maternity colonies. (However, see Kiser and MacGregor 2005 for precautions regarding early-season surveys between May 15 and June 1, as well as late-season surveys between August 1 and 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 indicates that a nursery colony is active in the area. Outside these dates, data cannot be used to document the presence or probable absence of summer populations.

EQUIPMENT

Mist nets to be used for Indiana bat surveys should be the finest, lowest visibility mesh commercially available: 1) In the past, this was 1 ply, 40 denier monofilament–denoted 40/1; 2) Currently, monofilament is not available, and the finest on the market is 2 ply, 50 denier nylon denoted 50/2; 3). The finest mesh size available is approximately 38 mm (~1 1/2 in).

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 below for minimum net heights, habitats, and other netting requirements that affect the choice of hardware.

NET PLACEMENT

Potential travel corridors such as streams or logging trails typically are the most effective places to net. 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. A typical set is 7 m high consisting of three or more nets stacked on top one another and up to 20 m wide. (Nets of different width may be used as the situation dictates).

Occasionally it may be desirable to net where there is no good corridor. Take caution to get nets up into the canopy. The typical equipment described in the section above may be inadequate for these situations, requiring innovation on the part of the researchers.

Exercise safety precautions when placing nets. Poles and nets must be clear of overhead wires.

See Kiser and MacGregor (2005) for additional discussion of net placement.

RECOMMENDED NET SITE SPACING

Stream and other linear corridors – one net site per km (0.6 mi) of stream or corridor.
Non-corridor study areas – two net sites per square km of habitat (equivalent to one net site per 123 acres).

The Service Field Office responsible for the state in which your project occurs should be consulted during survey design to resolve issues related to net site spacing for specific projects.

MINIMUM LEVEL OF EFFORT

Netting at each site should include at least four net nights, consisting of: 1) a minimum of two net locations at each site (at least 30 m apart, especially in linear habitat such as a stream corridor); and 2) a minimum of two nights of netting (i.e., two net locations for two nights = four net nights per site). A "net night" is defined as one net set up for one night. The sample period should begin at sunset and continue for at least 5 hours (longer sample periods may improve success). For purposes of determining presence or probable absence of Indiana bats, four net nights at a site are not required if Indiana bats are caught sooner (i.e., if Indiana bats are caught on the first night of netting, a second night is not required for purposes of documenting presence).

CHECKING NETS

Each net should be checked approximately every 10 minutes. Some researchers prefer continuous monitoring (with or without an electronic bat detector); care must be taken to avoid noise and movement near the nets if this technique is used. When monitoring the site continuously with a bat detector, bats can be detected immediately when they are captured in the net. Prompt removal from the net decreases stress on the bat and potential for the bat to escape (MacCarthy et al. 2006). Monitoring the net with a bat detector also allows the researcher to assess the effectiveness of their net placement (i.e., if bats are active near the nets but avoiding

capture); this may allow for adjustments that will increase netting success on subsequent nights. There should be no disturbance near the nets, other than to check nets and remove bats.

WEATHER AND LIGHT CONDITIONS

Severe weather adversely affects capture of bats. If Indiana bats are caught during weather extremes, it is probably because they are at the site and active despite inclement weather. On the other hand, if bats are not caught, it may be that bats are at the site but inactive due to the weather. Negative results combined with any of the following weather conditions throughout all or most of a sampling period are likely to require additional netting: 1) precipitation; 2) temperatures below 10°C; and/or 3) strong winds (use good judgment-- moving nets are more likely to be detected by bats). Further, consider human safety when netting during adverse weather.

It is typically best to set nets under the canopy where they are out of moonlight, particularly when the moon is ½-full or greater. Areas illuminated by artificial light sources should also be avoided.

DOCUMENTATION OF *MYOTIS SODALIS* CAPTURES

Photo documentation of *M. sodalis* captured during mist netting is not required, but is encouraged. Photos taken of a bat's head, calcar, tragus, toe hairs, etc. using a macro lens or a digital camera's macro-mode are often diagnostic and aid in validating the record.

If a bat from the genus *Myotis* is captured during mist netting that cannot be readily identified to the species level, species can be verified through fecal DNA analysis. Collect one or more fecal pellets (i.e., guano) from the bat in question by placing it temporarily in a holding bag (15 minutes is usually sufficient, no more than 30 minutes is recommended). The pellet (or pellets) collected should be placed in a 1.5 ml vial with silica gel desiccant; pellets from each individual bat should be stored in separate vials. Samples should be stored out of direct light. Samples should be shipped to Dr. Jan Zinck, Department of Biology, Portland State University, 630 SW Mill St., Portland, Oregon, 97201 for subsequent fecal DNA analysis to assign or confirm the specimens' identification to the species level. The current cost for sequencing is approximately $50 per individual pellet of guano. Contact Dr. Zinck (e-mail: zinckj@pdx.edu) prior to shipping samples. To our knowledge, this is the only lab that currently provides this service. Any additional information (or additional sources) on this technique will be made available on the Indiana bat webpage on the Service's Region 3 website (www.fws.gov/midwest).

REFERENCES TO CONSULT REGARDING MIST NETTING

Gardner, J. E., J. D. Garner, and J. E. Hofmann. 1989. A portable mist-netting system for capturing bats with emphasis on *Myotis sodalis* (Indiana bat). Bat Research News 30:1-8.

Kiser, J.D. and J.R. MacGregor. 2005. Indiana bat (*Myotis sodalis*) mist net surveys for coal mining activities. Pp. 169-172 *in* K.C. Vories and A. Harrington (eds.), The Proceedings of the Indiana bat and coal mining: a technical interactive forum Office of Surface Mining, U.S.

Department of the Interior, Alton, IL. Available at: http://www.mcrcc.osmre.gov/PDF/Forums/Bat%20Indiana/2-1.pdf. (Accessed October 27, 2006).

MacCarthy, K.A., T.C. Carter, B.J. Steffen, and G.A. Feldhamer. 2006. Efficacy of the mist-net protocol for Indiana bats: A video analysis. Northeastern Naturalist 13:25-28.

Murray K., E. Britzke, B. Hadley, and L. Robbins. 1999. Surveying bat communities: a comparison between mist nets and the Anabat II bat detector system. Acta Chiropterologica 1(1):105-12.

Murray, K.L., J.G. Boyle, J.C. Timpone, M.N. Miller, and L.W. Robbins. 2003. A test of the sampling protocol for Indiana bats. Bat Research News 44(1):25.

Robbins, L.W., K.L. Murray, J.G. Boyles, J.C. Timpone, M.N. Miller, and S.A. Kelly. 2003. Capture and detection of five species using Indiana bat protocol. Abstracts of papers presented at the 33rd annual North American symposium on bat research held 8-11 October 2003 in Lincoln, NE. Bat Research News 44(4):165.