MIST NETTING GUIDELINES
WITHIN NEW JERSEY AREAS AFFECTED BY
WHITE-NOSE SYNDROME IN BATS

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 while reducing the potential for spread of white-nose syndrome (WNS) in bats. Although the capture of bats confirms their presence, failure to catch bats does not absolutely confirm their absence. Netting effort as extensive as that 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 U.S. Fish and Wildlife (USFWS), New Jersey Field Office (NJFO). Submitting a survey plan to the NJFO for review and approval prior to conducting mist-netting is always recommended, particularly for large-scale netting efforts. The USFWS accepts the results of these surveys to determine species presence for the purposes of Section 7 consultation under the Endangered Species Act. Survey results are valid for at least two years.

DECONTAMINATION PROTOCOLS

To reduce the risk of unintentional, human-assisted spread of WNS while handling bats (both between handler and bats, between bats, and between handler and environment), strict adherence to the USFWS equipment decontamination protocols must be followed when conducting mist netting surveys in New Jersey. The most recent decontamination protocols are available at http://www.fws.gov/WhiteNoseSyndrome/research.html

These protocols will be revised and posted on the above website as new information becomes available. Therefore, the USFWS recommends checking the website to determine if protocols have been revised prior to each mist netting event.

NETTING SEASON

June 1 - August 15

New Jersey's known Indiana bat hibernacula sites have been confirmed to be affected by WNS, as are hibernacula in adjacent states. Therefore all areas of New Jersey within the known or potential summer range of the Indiana bat are considered to be WNS-affected. To allow surviving bats affected with WNS time to recover and to reduce the risk of spreading WNS, the summer mist netting season in New Jersey will be delayed until June 1.

Typically, May 15 - August 15 are the acceptable date limits for documenting the presence of summer populations of Indiana bats, especially maternity colonies[1]. 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 - Use 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. Mesh size of approximately 1 1/2 inches.

Hardware - No specific hardware is required. There are many suitable systems of ropes and/or poles to hold the 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 wooded streams, trails, and maintained rights-of-way typically are the most effective places to net. Place the 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 meters high, consisting of 3 or more nets "stacked" on top one another, and up to 20 meters 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 the nets up into the canopy. The typical equipment described in the section above may be inadequate for some situations, requiring innovation on the part of the surveyors. See Kiser and MacGregor (2005) for additional discussion of net placement. Exercise safety precautions when placing nets. Poles and nets must be clear of any overhead wires.

RECOMMENDED NET SITE SPACING

Stream and other linear corridors - 1 net site per km (0.6 miles) of stream or corridor.
Non-corridor study areas - 2 net sites per square km of habitat (equivalent to one net site per 123 acres).

The NJFO should be consulted during survey design to resolve issues related to net site spacing for specific projects. Submitting a survey plan to the NJFO for review and approval prior to conducting mist netting is recommended.

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1 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

MINIMUM LEVEL OF EFFORT

Netting at each site should consist of:

At least 4 net nights (unless bats are caught sooner) (1 net set for 1 night = 1 net night)
A minimum of 2 net locations at each site (at least 30 meters apart, especially in streams or linear corridors)
A minimum of 2 nights of netting

Sample Period:

Begin at sunset; continue netting for at least 5 hours

Additional net sets and longer sample periods may improve success. For purposes of determining presence or probable absence of Indiana bats, 4 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. However, if bats are not caught, it may be that bats are at the site but inactive due to the weather. Further, consider human safety when netting during adverse 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:

Precipitation
Temperatures below 10^{o}C
Strong winds (use good judgment - moving nets are more likely to be detected by bats.)

There is some evidence that small myotine bats avoid brightly lit areas, perhaps as predator avoidance. It is typically best to set nets under the canopy where they are out of moonlight, particularly when the moon is 1/2 full or greater. Areas illuminated by artificial light sources should also be avoided.

DOCUMENTATION OF INDIANA BAT CAPTURES

Photo documentation of Indiana bats 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 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 clean unused 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 collected in separate unused holding bags and placed 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. This is the only known 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 USFWS's Region 3 website (www.fws.gov/midwest).

REPORTING

Captures of summering Indiana bats should be reported to the NJFO within 5 business days. Initial information to be reported should include date(s) of capture, number of Indiana bats by age and sex, location (municipality, county, and coordinates), and a map, if available. Final survey reports should be submitted within 90 days of completion of the survey to the following address:

U.S. Fish & Wildlife Service
New Jersey Field Office
Attn: Endangered Species – Indiana Bat
927 N. Main Street, Bldg. D
Pleasantville, New Jersey 08232
Phone: (609) 646-9310
Fax: (609) 646-0352

A Scientific Collecting Permit from the New Jersey Department of Environmental Protection, Division of Fish and Wildlife is required to conduct mist netting within New Jersey. Information on obtaining a scientific collecting permit and State reporting requirements is available at http://www.state.nj.us/dep/fgw/scicolperm.htm

REFERENCES CITED

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):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.), Proceedings of Indiana bat and coal mining: a technical interactive forum. Office of Surface Mining, U.S. Department of the Interior, Alton, Illinois and Coal Research Center, Southern Illinois University, Carbondale, Illinois. Available at: http://www.mcrcc.osmre.gov/PDF/Forums/Bat%20Indiana/2-1.pdf. (Accessed 3/8/2010).

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.

ADDITIONAL REFERENCES TO CONSULT REGARDING MIST NETTING

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.