Efficacy of the Mist-net Protocol for Indiana Bats: A Video Analysis

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Abstract - We mist-netted bats to test the efficacy of the US Fish and Wildlife Service Indiana Bat Protocol (IBP), which recommends monitoring nets every 20 min. We continuously videotaped mist nets while monitoring and removing bats every 20 min. We recorded 157 bats on video that approached within 10 m of the mist net. Thirty-six bats (23.1%) avoided the net, 79 (50.0%) were caught and collected, and 42 (26.9%) were caught but escaped before we returned to check the net. We recommend that researchers check mist nets at intervals ≤ 10 minutes to potentially increase capture rates by ≥ 25%.

Introduction

Flying bats are difficult to capture because of their ability to avoid mist nets by detecting objects as thin as 0.06 mm in diameter (Kunz et al. 1996, Waldien and Hayes 1999). However, mist-netting is still the most common method of capture and has been used to study most bat species (Jones et al. 1996, Kunz and Kurta 1988), including the endangered *Myotis sodalis* Miller and Allen (Indiana bat) (Gardner et al. 1989). Mist-netting guidelines (MNG) of the US Fish and Wildlife Service (1999) Indiana Bat Protocol (IBP) recommend using a 2-ply, 50-denier nylon net with approximately 38-mm mesh and monitoring nets every 20 min to efficiently capture Indiana bats for accurate survey information. Our objective was to assess the MNG by quantifying the number of bats that escaped from nets during 20-min intervals.

Methods

We sampled sites within Shawnee National Forest in southern Illinois. Sites were dominated by bottomland hardwood forest, with closed canopy in close proximity to water. Dominant forest overstory species included *Quercus velutina* Lam. (black oak), *Q. palustris* Muench. (pin oak), *Q. alba* L. (white oak), and *Carya* spp. (hickories). Forested wetlands were characterized by an overstory of *Fraxinus* spp. (ash), *Platanus occidentalis* L. (sycamore), and *Liquidambar styraciflua* L. (sweetgum), with few woody understory species.

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We randomly sampled 8 sites using the IBP methods between 20 May and 19 August 2003, in the vicinity of known Indiana bat maternity colonies (Carter 2003). We used high net systems similar to those described by Gardner et al. (1989) with 2-ply, 38-mm mesh, 50-denier nylon nets (Avinet, Inc., Dryden, NY) ranging from 6–12 m wide. Net sets were placed over water or in flight corridors in closed canopy forest. Nets were opened at dusk and remained open for approximately 4 hrs. We monitored each mist net every 20 min for captured bats.

Bat activity was recorded each night using a Sony Hi8 Handycam® camcorder (model CCD-TRV98, Sony Corp., Tokyo, Japan) in Night Shot® mode placed approximately 10 m in front of the mist net. Two infrared lights (Infrared Light HVL-IRM, Sony Corp., Tokyo, Japan) were placed parallel to the front of the net and angled approximately 45° up across the net to provide illumination for the camera. Videotapes were analyzed to determine the number of bats that approached the net, the number of these that avoided the net, the number captured, and the number of bats that escaped before we returned to monitor the net. We determined the amount of time each bat spent in the net using the built in timer on the video camera. Because Carroll (2001) recaptured only 2 of 416 individual bats in southern Illinois, we did not mark captured bats in this study to test for recaptures.

Results

We videotaped 29 net nights, resulting in 120 hrs of video footage. We recorded 157 bats approaching the net, of which 36 (23%) completely avoided the net. One hundred twenty-one bats (77%) became entangled in the net. Of these, 42 (35%) escaped and 79 (65%) were released during the net check. Bat species captured and released included 24 Indiana bats, 18 *Lasiurus borealis* (Muller) (red bats), 16 *Pipistrellus subflavus* (Cuvier) (eastern pipistrelles), 9 *Eptesicus fuscus* (Beauvois) (big brown bats), 8 *Myotis septentrionalis* van Zyll de Jong (northern long-eared bats), and 4 *Myotis lucifugus* (LeConte) (little brown bats). Of the 42 bats that escaped from the net before the 20 min net check, 24 escaped in < 5 min, 12 escaped in < 10 min and 6 took > 10 min to escape.

Discussion

We assessed how time between net checks influenced the capture success of Indiana bats following the IBP and provided insight on the number of bats that completely avoided mist nets. The IBP suggests monitoring mist nets every 20 min for Indiana bats (USFWS 1999). We successfully captured 50% of the bats videotaped following these guidelines. However, the potential to capture more bats with minimal additional effort existed. We suggest that researchers could potentially capture about 25% more bats if the net-check time was decreased to 5–10 min or capture 30% more bats if nets were

monitored continuously. Our presence at mist nets as we removed entangled bats did not appear to deter additional bats from flying into the nets, as approximately 20 bats flew into the mist net while we checked it. Disturbance as we approached mist nets increased entangled bat activity, chewing, and possibility of escape. Therefore, we recommend that researchers check nets at intervals of < 10 min. Researchers should approach nets quietly and avoid communication until all entangled bats have been restrained. Researchers surveying for bats should monitor mist nets continuously, but especially for endangered species because numbers are low.

Although we were unable to identify species of bats that escaped from the nets, most escapees were the larger, more aggressive bats. Generally, these were big brown and red bats that chewed through mist net strands and freed themselves. Conversely, smaller, more timid bats such as Indiana bats, eastern pipistrelles, and northern long-eared bats generally remained entangled longer. Given the small body size of Indiana bats, escapes may be minimal and the current IBP guidelines may be adequate, nonetheless we recommend net checks at 10-minute intervals or less.

Future studies involving infrared lights may benefit by modifying the methods that we used. We believe using at least four infrared lights would have increased the net illumination and our ability to detect bats. The infrared light sources were most efficient when placed parallel to the net and angled approximately 45° vertically. Light sources placed at the top and bottom of the net and angled 45° up and down would likely increase illumination sufficiently to reduce blind spots and dark areas. Camera equipment with digital technology could increase the resolution and clarity of video imagery and thus enhance the ability to detect and identify bats. Further, research could assess whether the use of infrared lighting promotes insect activity and bat capture or acts as a potential deterrent.

Acknowledgments

This project was done in conjunction with long-term studies on the Indiana bat funded by the US Forest Service. We thank S. Widowski, Shawnee National Forest, for his continued support and N. Seward, USDA APHIS Wildlife Services, for reviewing an earlier draft of the manuscript.

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