A COMPARISON OF MIST NETS AND ULTRASONIC DETECTORS FOR MONITORING FLIGHT ACTIVITY OF BATS

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There are several recent studies reporting nocturnal flight activity of bats based on samples taken using mist nets (Gaissler, 1973; Kunz, 1973, and references). The known effects of disturbance and suspected bias resulting from this method (see Cockrum and Cross, 1964; O’Farrell and Bradley, 1970; Gaissler, 1973; Kunz, 1973) pose the question of whether mist nets yield representative data on flight activity. At best, results obtained from this method provide information on flight activity only at sites which can be successfully netted. In the temperate zone, such success usually is achieved only over small bodies of water, along flyways, or at roost entrances. Bat traps (Tuttle, 1974) may be used more profitably than mist nets at roost entrances due to the large numbers of bats usually encountered there, but they too have their limitations owing to a small areal coverage and the somewhat limited conditions under which they can be successfully used. Furthermore, flight activity of bats is known to vary in different habitats (Fenton, 1970; Kunz, unpublished), and mist nets cannot always be used successfully to assess these differences, especially in open areas such as fields and over large bodies of water, or in the canopy above practical netting heights.

Ultrasonic detectors also have been used to assess flight activity of bats (Fenton, 1970; Voite, 1973) and this method has proved especially useful, in the temperate zone, near summer colonies and in adjacent habitats where single species predominate. Ultrasonic detectors also impose several limitations, including the facts that species usually are indistinguishable and that “bat passes” may represent separate recordings of many individuals in addition to repeated recordings of a single bat (see Fenton et al., 1973). Consequently, the number of bat passes recorded bears no relationship to the absolute number of bats present. Other limitations include differential sensitivities and detection limits when two or more detectors (of the same or different types) are being used; furthermore, the possibility exists that detectors may fail to register all or some bat sounds since the latter are known to vary in frequency and pattern under different conditions (Griffin, 1958, 1971). In spite of these and other limitations, the use of mist nets and ultrasonic detectors for studying flight activity of bats has gained in popularity. This study was undertaken to compare the results from these two methods.

The study area was located in a mixed deciduous-coniferous woodland in southern New Hampshire, near Peterborough, Hillsborough County. Flight activity was monitored over a small (1.0 hectare) pond, located approximately 600 meters (m) NW of a barn housing a summer colony of Myotis lucifugus, and along a roadway 100 m N of the barn. Dominant vegetation in the area included sugar maple (Acer saccharum), birch (Betula spp.), beech (Fagus grandifolia), white pine (Pinus strobus), and hemlock (Tsuga canadensis). Understory and riparian vegetation was dominated by rhododendron (Rhododendron spp.) and alder (Alnus spp.). The area over and adjacent to the pond, apparently was used by
bats mostly as a flyway enroute to preferred foraging areas over a nearby river wetland, although some feeding was known to occur at the pond.

Mist nets (6 and 12 m lengths) were positioned adjacent to and over a small inlet of the pond in July and August 1973 (Fig. 1), and they were checked at 15 minute intervals from dusk to dawn. Captured bats were removed from nets and processed according to Kunz (1973), except that bats were not banded until the final night of netting. The latter procedure was followed in order to eliminate additional bias that may have been caused by banding.

Fig. 1.—The effect of alternate mist net positions on capture success of bats. Net positions (lines) over and adjacent to the pond are designated by letters (A–D). Short lines represent 6 m nets and long lines represent 12 m (or two 6 m) nets. Positions and orientation are given for the two ultrasonic detectors (net site and non-net site) at the pond. Letter combinations (with subscripts) on graph denote the initial and subsequent nights that each net position was used.

Ultrasonic detectors (Holgate bat detectors and others described in Fenton et al., 1973) were coupled to pulse discriminators and data output was recorded on a Rustrak event recorder. Each detector was tuned to or fixed at a receiving frequency of 40 ± 2 kHz inasmuch as *M. lucifugus*, as well as other local bats emit terminal pulses within this range (Griffin, 1958). Because cruising pulses, reported for the species observed in this study, generally are above 40 kHz, and since terminal pulses (characteristic of the final approach in insect pursuit) go down to and below this frequency, it is likely that the registered bat passes represented feeding bats. Other bats present in the area (and not feeding) may have gone undetected.

In six nights of mist netting (14 “six-meter-equivalent” net nights), 65 bats were captured, including 57 *M. lucifugus*, seven *M. keenii*, and one *Lasiusus borealis*. Capture success decreased substantially on the second night of netting in a given position, but when nets were shifted to an alternative position on a subsequent night, capture success was
improved markedly (Fig. 1). There also were differences in capture success at different net sites owing to the nature of the surrounding vegetation. Capture success was highest at sites where overhanging branches from nearby trees formed a partial canopy over nets. The fact that capture success decreased on the second night of netting in the same position suggests that many of the same individuals were using the pond as their flyway and that the decrease in capture success involved a learned response to the net position. Alternatively these results reflect a general increase in alertness to all new obstacles in an area. I was unable to test the former hypothesis because bats were not banded until the last night, and furthermore, capture success of banded individuals is extremely low under these and similar conditions (see Kunz, 1973). On theoretical grounds it can be expected
that bats would use the same flyway enroute to foraging areas each night in order to eliminate the necessity of learning unfamiliar obstacles.

The following data on flight activity, at a given site, were pooled because it was not possible to compare the results of a single night's capture with a given nightly ultrasonic record owing to the usually small, nightly mist net samples. We feel that this procedure is justified because there were no significant intrasite differences in flight activity based on ultrasonic detection throughout the study. In spite of any unexpected bias resulting from our pooled data, the temporal flight activity revealed from mist net captures and from ultrasonic detection both reveal strikingly similar bimodal patterns with an initial peak of activity after dusk and a second one shortly before dawn (Fig. 2a and 2b).

A comparison of flight activity using data from an ultrasonic detector at the net site and another at the non-net site (water was too deep to make netting practical) reveals similar patterns of temporal activity (Fig. 2b and 2c). Flight activity monitored with an ultrasonic detector along a roadway (Fig. 2d) yielded similar data to that obtained at the two pond sites (Fig. 2b and 2c).

The above data clearly demonstrate the similarity of flight activity using either mist nets or ultrasonic detectors; thus, if the assessment of temporal activity is the primary objective of a study, it is evident that the time and effort of obtaining equivalent information is much less using ultrasonic detectors. Furthermore, a representative pattern of flight activity can be obtained on a single night using ultrasonic detectors, whereas it may take several nights of netting in order to secure adequate numbers of bats to demonstrate comparable results. Capture success may decrease markedly at a given site following repeated netting efforts (unless alternative net positions are used—Fig. 1), whereas ultrasonic detection may be used repeatedly at a given site (to monitor seasonal patterns of flight activity) without the bias associated with netting. Finally, use of ultrasonic detectors can provide important information on flight activity at sites where netting is impossible or impractical.

Inasmuch as species discrimination usually is not possible using the aforementioned ultrasonic recording system (Fenton et al., 1973), information on differential flight periodicity of sympatric species (Kunz, 1973) cannot be determined. Nonetheless, ultrasonic detectors are useful for monitoring flight activity near roosts, along flyways, and in feeding areas used by single species and where species composition has been confirmed by capture. If information on species composition, sex, age, and reproductive condition is desired, in addition to flight activity, mist nets and bat traps represent, at present, the only satisfactory alternatives. An important use of ultrasonic detectors in areas of mixed species composition may be in determining the optimum habitat and time where mist nets can be successfully employed. This procedure could reduce the necessity of setting mist nets in unproductive habitats and at the same time reveal unsuspected habitats where netting could be productive.

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LITERATURE CITED


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