Surveying Nocturnal Bird Communities of the Southeast with Silent and Playback Methods

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Abstract: Accurate nocturnal bird abundance and distribution data are necessary for managing nocturnal avian communities. We compared vocalization playback and silent methods for surveying 3 nocturnal avian species in Mississippi in 1997 and 1998. Playback elicited more responses from eastern screech-owls *(Otus asio)* than the silent method. Playback was more effective than the silent method at detecting habitat associations of eastern screech-owls, which were strongly associated with pine regeneration stands than pine sawtimber stands and pine-hardwood stands. Playback of broadcast vocalizations more effectively detects abundance of some nocturnal bird species than silent methods. Increased detectability and accuracy are essential for monitoring and managing nocturnal avian communities and their habitat associations.

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Avian abundance is typically quantified using fixed-radius point counts (Hutto et al. 1986). Although this method has contributed to a greater understanding of population trends for some migrant and resident avian species, nocturnal birds are rarely detected. Nocturnal birds rarely sing during diurnal point counts or are omitted due to small sample sizes (Mosher et al. 1990). When specifically investigating nocturnal species, researchers often focus on a single species and use silent methods (Nowicki 1974, Bjorklund and Bjorklund 1983).

An alternative to silent counts is playback of conspecific vocalizations. Playback may increase responses of some nocturnal species compared with silent counts (McGarigal and Fraser 1985, Moller 1990, Mosher et al. 1990, Gerhardt 1991). Playback has been used successfully to index relative abundance of nocturnal (Cooper 1981, Vilella and Zwank 1993, Pardieck et al. 1996) and diurnal species (Dow 1970, Sliwa and Sherry 1992, Graves 1996), and has been suggested as a population monitoring method for bird communities (Gerhardt 1991, McLeod and Andersen 1998).

Our objectives were to: (1) compare playback and silent survey methods and (2) assess playback as a method to determine habitat associations of nocturnal bird species. We tested 2 null hypotheses: (1) playback and silent methods elicited an equal number of responses from nocturnal bird species and (2) playback and silent methods were equally effective at detecting habitat associations of nocturnal bird species.

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Methods

Research was conducted at Bienville National Forest, Scott County, Mississippi. Bienville National Forest encompasses 72,216 ha of predominantly loblolly pine *(Pinus taeda)* and pine-hardwood stands in south-central Mississippi. Bienville National Forest is intensively managed for the federally-endangered red-cockaded woodpecker (*Picoides borealis;*U.S. Fish and Wildl. Serv. 1985, U. S. For. Serv. 1995). Current management includes long timber rotations (≥70 years), hardwood midstory removal, and prescribed burning at 2- to 3-year intervals.

We established 2 roadside call-count routes on secondary roads, consisting of 18 stations/route spaced 0.8 km apart (Mosher et al. 1990). Routes were located in areas with similar vegetation composition, structure, and habitat patch arrangement in the landscape. Call count stations were allocated to 3 habitat types including: pine sawtimber (>30 years, *N*=17), co-dominant pine-hardwood sawtimber (>30 years, *N*=12), and pine regeneration (>10 years, *N*=7). We classified each station based on habitat composition within a 0.4 km radius circle around each call count station. All call count stations sampled exhibited >80% habitat homogeneity of habitat composition.

Routes were conducted weekly from 15 May to 15 July during 1997 and 1998. To compare silent and playback methods, we conducted both methods on the same night, but on different routes. Methods and route directions were alternated weekly to minimize method, route direction, route, and observer bias (Dow 1970). Although moonphase (e.g., full moon) has been reported to influence calling behavior of nightjars (Caprimulgidae; Cooper 1981) and owls (Strigidae; Mills 1986), this relationship was weak for several owl species (Pardieck et al. 1996). Logistical limitations prevented synchronizing call-count routes with moonphase (e.g., full moon).

At each station, a 10-minute silent count was conducted and all birds detected

within 0.4 km were recorded (Nowicki 1974). For the playback method, we prepared a 6-minute tape of songs for 3 target species: chuck-will's-widow *(Caprimulgis carolinensis),* eastern screech-owl *(Otus asio)*, and barred owl *(Strix varia)* Although McGarigal and Fraser (1985) found no evidence that larger competitors or predators suppressed responses by smaller species, we stratified the order of species culminating with barred owl. The playback tape consisted of 6 consecutive 1-minute blocks with a 1-minute block of a species' song followed by a 1-minute block of silence (e.g., chuck-will's-widow, silence, eastern screech-owl, silence, barred owl song, silence). Mosher et al. (1990) reported that barred owls were more likely to be detected post-broadcast, therefore we incorporated a 1-minute block of silence post-broadcast for each species. Responses were recorded during each 1-minute block.

A U. S. Sporting Products Model 87™ portable cassette player was used to broadcast calls at each station. Call count routes began at sundown and were only conducted if Breeding Bird Survey conditions were met (Cooper 1981, Robbins et al. 1986).

We used SAS (1988) for all statistical analyses, with an alpha level=0.05. Our data, representing counts of calling birds or visual observations, fit a Poisson distribution, therefore we used PROC GENMOD on actual counts of birds to test our null hypotheses (SAS 1988). PROC GENMOD performs an analysis of variance specified for a Poisson data distribution. PROC GENMOD provides a χ^2 test statistic for responses within station, over repeated trials. We used a repeated measures statement (subject=station) to control for temporal dependence. If no year effect was detected, we pooled years prior to further analysis. For analysis of habitat associations, if a significant main effect was detected, we constructed linear contrasts to compare individual habitat associations within methods (SAS 1988).

Results

Playback and Silent Methods

Response to playback and silent methods differed among species (Table 1). Playback elicited greater responses by eastern screech-owls (χ^2_1=116, P<0.01). Barred owls (χ^2_1=1.04, P=0.31) and chuck-will's widows (χ_1=0.18, P=0.68) did not respond differently to playback and silent methods. Responses for all species did not differ between years and was consistent between years (P>0.05).

Habitat Associations and Detectability

Analysis of the playback method indicated a difference in habitat associations for eastern screech-owls (χ^2_2=6.53, P=0.04). Eastern screech-owls were more strongly associated with pine regeneration stands than pine sawtimber (χ^2_1=4.87, P=0.03) and pine-hardwood sawtimber (χ^2_1=5.74, P=0.02) stands (Table 2). For the silent method, no differences in habitat associations were detected for eastern screech-owls (χ^2_2=2.57, P=0.28).

Table 1. Mean number of nocturnal birds per station responding to playback and silent methods at Bienville National Forest, Mississippi (1997–1998). Data are $\bar{x}$ ± SE.

Species	Method	1997	1998	1997–1998
Barred owl	Playback	1.25 ± 0.27	0.88 ± 0.18	1.06 ± 0.16
	Silent	0.93 ± 0.18	0.85 ± 0.16	0.89 ± 0.12
Chuck-will's-widow	Playback	1.60 ± 0.23	1.33 ± 0.27	1.46 ± 0.18
	Silent	1.58 ± 0.31	1.50 ± 0.26	1.55 ± 0.20
Eastern screech-owl	Playback	2.73 ± 0.30	2.38 ± 0.32	2.55 ± 0.22
	Silent	0.68 ± 0.13	0.40 ± 0.10	0.54 ± 0.08

Table 2. Mean number of eastern screech-owl detected per station by habitat type at Bienville National Forest, Mississippi (1997–1998). Data are $\bar{x}$ ± SE. Habitat types include: pine sawtimber ($N = 17$), pine-hardwood sawtimber ($N = 12$), and pine regeneration ($N = 7$).

Method	Pine Sawtimber	Pine-hardwood sawtimber	Pine regeneration
Playback	5.0 ± 0.60	4.67 ± 0.90	7.43 ± 1.72
Silent	0.94 ± 0.22	1.0 ± 0.21	1.71 ± 0.42

Discussion

Playback Versus Silent Method

Playback was highly effective at eliciting a greater number of responses than the silent method for eastern screech-owls, supporting other studies documenting a vigorous response to playback by this species (Nowicki 1984, Ritchison et al. 1988). Playback did not increase detection of barred owls or chuck-will's-widows, but this result may be misleading. Only 2 routes were sampled which limited the scope of inference for detecting variation in response to playback and silent methods. Increased replication of routes would permit greater inference in future studies.

Although playback did not affect response rate of barred owls and chuck-will's-widows statistically, individuals of both species frequently approached the cassette player during playback of conspecific song (Ritchison et al. 1988). Mobbing behavior implies that these species respond to playback, but other factors may account for the lack of a statistically significant response. Mobbing behavior by territorial chuck-will's-widows and barred owls may simply be a function of proximity to the tape player. It also is possible that chuck-will's-widows located further from the tape player may not have responded to playback due to the presence of territorial chuck-will's-widows closer to the tape player. Barred owls have large home ranges that may account for the lack of a significant response to playback. The tape player may have

been at the periphery of a barred owl's range or distant from the owl's location at a given time.

We only conducted monitoring during the summer months, and some owl species may be more territorial during winter. During winter (Nov–Feb), barred owls and great horned owls *(Bubo virginianus)* are more territorial due to breeding activity. Therefore, monitoring protocols that encompass both winter and summer months should more effectively survey the nocturnal bird community.

Although our results indicate barred owls and chuck-will's-widows did not respond to playback as strongly as eastern screech-owls, other researchers have demonstrated significant responses to playback by nocturnal birds. Mottled owls *(Ciccaba virgata)* demonstrated a 40% response rate to playback compared to a 9% response rate during silent counts (Gerhardt 1991). McGarigal and Fraser (1985) reported a 63% response rate to playback by barred owls.

Habitat Associations and Detectability

Playback was more effective at detecting differences in abundance among habitat associations than the silent method. The playback method detected 2 differences in habitat associations, whereas the silent method failed to detect any habitat differences. The playback method indicated that eastern screech-owls were strongly associated with pine regeneration stands compared to pine sawtimber and pine-hardwood sawtimber stands. Eastern screech-owl affinity for pine regeneration stands may be due to adequate escape cover and increased prey availability. However, we did not attempt to demonstrate habitat selection *per se,* but merely to demonstrate the value of using playback to determine the habitat associations of a nocturnal bird species.

Management Implications

Scientific wildlife management relies on the use of accurate data. Silent methodologies, although effective for diurnal avian species, may underestimate some nocturnal species, such as the eastern screech-owl. To effectively monitor nocturnal avian species, the use of playback may be valuable. Furthermore, playback may enhance researchers' abilities to detect habitat associations of birds. A monitoring protocol performed during winter and summer months would further enhance our understanding of nocturnal bird communities. We strongly recommend the further development of playback methods for surveying nocturnal bird communities.

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