SHORT COMMUNICATIONS

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DIFFERENTIAL EFFECTIVENESS OF PLAYBACKS FOR LITTLE OWLS (*ATHENE NOCTUA*) SURVEYS BEFORE AND AFTER SUNSET

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Most nocturnal owls respond to broadcast of conspecific recordings, and this technique may be used to study their behavior (Galeotti and Pavan 1993, Galeotti et al. 1997), to map territories (Finck 1990, Lane et al. 2001), to identify individuals (Galeotti and Sacchi 2001, Delport et al. 2002), or to study population trends (Exo and Hennes 1978, Martínez and Zuberogoitia 2004). Several factors affecting the effectiveness of playback techniques or spontaneous vocalizations have been identified, including response distance (Proudfoot et al. 2002), season (Zuberogoitia and Campos 1998), weather (Lengane and Slater 2002), gender, and social status (Appleby and Redpath 1997). However, only a few studies have investigated systematically how these factors influence playback methodology (McGarigal and Fraser 1985, Redpath 1994, Centili 2001). When comparing the accuracy of sampling using spontaneous owl vocalizations or conspecific playbacks, several authors demonstrated that sampling error increases when using spontaneous calls (McGarigal and Fraser 1985, Haug and Didiuk 1993, Redpath 1994). However, for Eurasian Eagle-Owl (*Bubo bubo*), passive auditory surveys provide better results than surveys based on broadcast calls (Penteriani and Pichera 1991, Martínez and Zuberogoitia 2002).

The Little Owl (*Athene noctua*) is a territorial species widely distributed in Palearctic regions. This small raptor inhabits a wide variety of semi-open areas, from steppes and stony semideserts to farmlands and open woodlands, and villages and urban areas (Cramp 1985). Little Owls prey on insects, small mammals, and birds, and hunt both during diurnal and nocturnal hours (Negro et al. 1990). Researchers have surveyed Little Owls by listening to spontaneous vocalizations or by playing typical calls to provoke the territorial vocalization after sunset (Finck 1990, Exo 1992, Mastrorilli 1997, Zuberogoitia and Campos 1998, Verwaerde et al. 1999, Pirovano and Galeotti 1999) or before sunset (Martínez and Zuberogoitia 2004). Territorial defense is performed mostly by males, which are more vocal than females (Mikkola 1983, Finck 1990, Zuberogoitia and Campos 1998).

Here, we examine the effectiveness of the playback method to detect Little Owls before or after sunset. Specifically, we tested whether broadcast before or after sunset would elicit the greater response frequency and whether duration of playback affected the Little Owl response rate. We also offer some suggestions to improve the survey methodology.

STUDY AREA AND METHODS

We conducted the study in Clot de Galvany Council Natural Park (southeastern Spain, Province of Alicante). The study area (ca. 650 ha.) was characterized by a mosaic of shrubs, saline grasslands, and mixed forest, interspersed with extensive abandoned arboreal cultures such as almond and olive trees. The area exhibits a semiarid Mediterranean climate (Sancho and López 2002).

Between 19 April–17 May 2002 (the courtship and territorial defense period; Mikkola 1983, Finck 1990), we surveyed twice (before and after sunset) for Little Owls at 14 permanent stations during five sessions (10 d). Each day, survey stations were sampled with three different "survey" experiments, seven before and seven after sunset. The first survey was made 2 hr before sunset (1900–2100 H). The second survey was done 2 hr after sunset (2130–2330 H). These survey experiments were: (1) Spontaneous Calls: the observer listened for 2 min, registering the response rate (number of different Little Owls heard); (2) First Playback: after the spontaneous calls trial, a territorial intrusion was simulated by broadcasting territorial calls of Little Owl for 2 min using a

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cassette-player. Then, the observer listened for 1 min, recording the response; (3) Second Playback: after the first playback (1 min later), a new territorial intrusion was simulated by broadcasting territorial calls for 2 min by using a cassette-player. The observer listened for 1 min, recording the total response rate (response rate of first and second playback). The sequence of stations surveyed was reversed every other visit. To reduce the number of Little Owls that could be potentially counted twice, the distances between survey stations were at least 500 m (Finck 1990, Exo 1992, Centili 2001). To avoid differences associated with possible bias in sound direction, we always used the same cassette-player (power: 4 watts, Sony WN-FX 195, Barcelona, Spain), placed on the ground with the loudspeakers directed upwards. To minimize the potential of lower response rates (i.e., owls becoming less responsive because they habituated to our broadcasts), we used territorial male calls from five different individual owls (Roché 1996, SEO 1998, Llimona et al. 2002). We did not conduct experiments on windy or rainy days.

Because data were not normally distributed, we used nonparametric tests for statistical analysis (Zar 1996). To avoid pseudoreplication, we used the mean of response rate for each survey station. Statistical analyses were carried out using the SPSS statistical package (SPSS for Windows 1999). Two-tailed *P*-values were used throughout and statistical significance was set at $P < 0.05$.

RESULTS

Before sunset, spontaneous Little Owl calls were heard at only two stations (Table 1). In contrast, Little Owls were detected after sunset by spontaneous calls at nine stations (Table 1). As expected, more Little Owls sang spontaneously after sunset than before (Kruskal-Wallis test, $\chi^2 = 10.39$, df = 1, $P < 0.001$). Numbers of Little Owls detected by passive auditory surveys were significantly lower than those detected by playback surveys, both before and after sunset (Fig. 1). These differences were shown in both the comparison with the first playback (before sunset: $\chi^2 = 22.07$, df = 1, $P < 0.001$; after sunset: $\chi^2 = 19.84$, df = 1, $P < 0.001$), and the second playback (before sunset: $\chi^2 = 28.17$, df = 1, $P < 0.001$; after sunset: $\chi^2 = 25.73$, df = 1, $P < 0.001$). Playback surveys detected more individuals after sunset than before (first playback before vs. after sunset: $\chi^2 = 6.83$, df = 1, $P < 0.001$; second playback before vs. after sunset: $\chi^2 = 4.51$, df = 1, $P = 0.03$), but there were no differences between the two playback experiments within each period (first playback vs. second playback before sunset: $\chi^2 = 0.55$, df = 1, $P = 0.46$, first playback vs. second playback after sunset: $\chi^2 = 0.03$, df = 1, $P = 0.87$; Fig. 1).

DISCUSSION

Our results strongly suggest that nocturnal broadcast surveys were the most effective method for surveying Little Owls, both for detecting presence and counting individuals or territories (Zuberogoitia and Campos 1998, Verwaerde et al. 1999, Centili 2001, van Nieuwenhuyse et al. 2002). These results are in accordance with similar studies with other owls: Barred Owl (*Strix varia*; McGarigal and Fraser 1985), Tawny Owl (*Strix aluco*; Redpath 1994), Burrowing Owl (*Athene cunicularia*; Haug and Didiuk 1993), Ferruginous Pygmy-Owl (*Glaucidium brasilianum*; Proudfoot and Beasom 1996), and Long-eared Owl (*Asio otus*; Martínez et al. 2002).

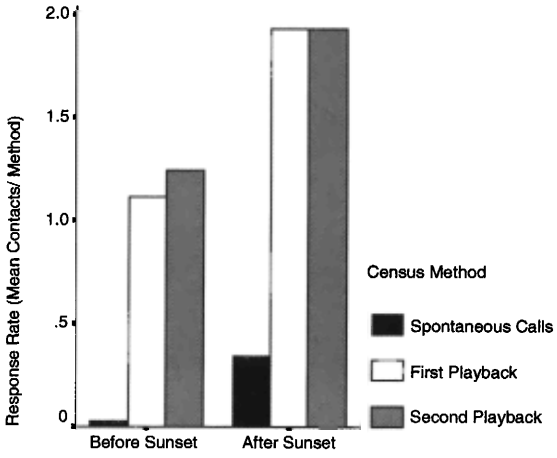

Figure 1. Call rates (calling means for Little Owls per survey station) detected without using playback (spontaneous calls), using first and second playback both before and after sunset.

Interestingly, our study indicated that Little Owls responded at a similar rate in the first and the second playback (before and after sunset). The fact that our first playback experiment, broadcasting for 2 min, elicited a similar number of owls as when both playbacks were included, suggested that 2 min of continuous playback was sufficient for detecting Little Owls, which was a shorter period than that used in other studies of this species (5 min, Zuberogoitia and Campos 1998; 4 min, Verwaerde et al. 1999; 3 min, Centili 2001).

Detection rate of Little Owls after sunset was less variable and higher than before sunset (Table 1, Fig. 1). Thus, before sunset, surveys may underestimate the number of breeding Little Owls in an area. However, the use of playback before sunset would be useful in finding territories and nests because individuals might be observed when calling at perches (Martínez and Zuberogoitia 2004, pers. obs.).

Estimating the breeding density of owl species is an important part of population studies, and comparisons are widely used to assess the abundance of a species across years and geographical areas. Biased estimates of breeding pair density are misleading and prevent comparisons between studies. Thus, increased efficiency of survey methods and knowledge of potential error is necessary. Our results suggest broadcasting 2 min of conspe-

Table 1. Mean call rates (number of different owls calling at each survey station/number of trials ±SD) of Little Owls at Clot de Galvany Park, Alicante Province, Spain. Data were obtained during five visits/survey station; protocol included recording spontaneous calls followed by playback of conspecific calls.

Station	Before Sunset			After Sunset		
	Spontaneous Calls	First Playback	Second Playback	Spontaneous Calls	First Playback	Second Playback
1	0	1.00 ± 1.00	0.80 ± 0.84	0.20 ± 0.45	1.60 ± 1.14	2.20 ± 1.48
2	0	0.60 ± 0.89	0.60 ± 0.89	0.20 ± 0.45	1.60 ± 0.89	1.40 ± 1.34
3	0	1.00 ± 0.71	2.20 ± 0.83	0	3.40 ± 0.34	3.20 ± 0.84
4	0	0.60 ± 0.55	0.20 ± 0.45	0.20 ± 0.45	1.00 ± 1.00	0.60 ± 0.89
5	0	1.00 ± 0.00	1.00 ± 0.00	0	1.00 ± 0.71	0.80 ± 0.45
6	0	2.20 ± 0.84	2.00 ± 1.58	0.80 ± 1.60	2.40 ± 0.89	3.20 ± 0.84
7	0.20 ± 0.45	0.80 ± 0.45	1.00 ± 0.71	0.40 ± 0.55	1.89 ± 0.84	1.40 ± 0.55
8	0.20 ± 0.45	1.60 ± 1.14	1.80 ± 0.84	0.80 ± 0.84	2.20 ± 0.84	2.60 ± 0.55
9	0	1.80 ± 0.84	2.00 ± 0.00	0.40 ± 0.89	2.60 ± 1.14	2.20 ± 1.30
10	0	1.60 ± 0.89	1.00 ± 0.71	0	1.40 ± 0.55	1.20 ± 1.30
11	0	0.40 ± 0.89	0.60 ± 0.55	0.40 ± 0.55	0.80 ± 0.45	1.00 ± 1.41
12	0	2.00 ± 1.22	2.00 ± 1.41	0	3.00 ± 0.71	3.00 ± 0.71
13	0	0.60 ± 0.55	1.20 ± 1.10	0.60 ± 0.89	1.60 ± 1.34	1.40 ± 1.34
14	0	0.40 ± 0.89	1.00 ± 1.22	0	2.60 ± 0.89	2.80 ± 0.45
Total	0.03 ± 0.01	1.10 ± 0.62	1.24 ± 0.64	0.29 ± 0.29	1.94 ± 0.79	1.93 ± 0.92

cific songs just after sunset elicits vocal responses effectively from resident Little Owls.

DIFERENTE EFECTIVIDAD DEL PLAYBACK PARA CENSAR MOCHUELO EUROPEO (*ATHENE NOCTUA*) ANTES Y DESPÚES DEL ANOCHECER

RESUMEN.—Los búhos son difíciles de contar pues son poco conspicuos, tienen hábitos nocturnos y duante el día permanecen perchados en sitios ocultos. La reproducción de vocalizaciones previamente grabadas ha sido considerada un modo eficiente para determinar la presencia de estas sigilosas rapaces. En este estudio examinamos la efectividad y precisión de la reproducción de vocalizaciones para detectar individuos de la especie *Athene noctua*. Los censos en los que se reprodujeron llamados espontáneos fueron menos eficientes que aquellos en los que se reprodujeron vocalizaciones coespecíficas pregrabadas. La tasa de detección luego del atardecer fue mayor y menos variable que la tasa previa al atardecer. Esto sugiere que los censos nocturnos con vocalizaciones podrían ser el método más efectivo para detectar la presencia de *A. noctua* y para contar los individuos y territorios de esta especie.

[Traducción del equipo editorial]

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