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USE OF RECORDED CALLS TO DETECT BURROWING OWLS

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Abstract.—A technique designed to aid in censusing Burrowing Owls (*Speotyto cunicularia*) was evaluated in southcentral Saskatchewan in 1982 and 1983. Known nest sites were surveyed by broadcasting conspecific calls and the owls' behaviors were evaluated for types of responses. The male owls were very responsive (84%) using the territorial posture with primary song 64% of the time. This behavior and others (flying, "white and tall" stance, alarm bob and call and copulation) increased the detection of all owls by 53%; male owls increased by 38% and female owls by 100%. Response rates did not differ between morning and evening surveys, but phenology did have a significant negative affect on response rates of all owls.

USO DE LLAMADOS GRABADOS PARA DETECTAR LA PRESENCIA DE *ATHENE CUNICULARIA*

Sinopsis.—De 1982 a 1983 se diseñó y evaluó una técnica para hacer censos del buho *Speotyto cunicularia* en la parte surcentral de Saskatchewan. Se examinaron áreas donde se sabía de la presencia de las aves, y mediante el uso de grabaciones de llamados, se evaluó la conducta de las aves de acuerdo al tipo de respuesta a las llamadas. Los machos de la especie respondieron muy bien a las grabaciones (el 84% de las ocasiones), utilizando en el 64% de los casos una postura territorial unido a su canto primario. Esta conducta, al igual que otras, incrementó la detección de estos buhos en un 53%; los machos en un 38% y las hembras en un 100%. No se eoncontraron diferencias en la tasa de respuesta en las encuestas hechas durante la mañana y el anochecer, pero la fenología tuvo un efecto negativo significativo en la tasa de respuesta de todas las aves.

During a 1981 inventory of Burrowing Owls (*Speotyto cunicularia*) in a southcentral Saskatchewan study area, we found 32 nesting sites with a minimum of 57 breeding pairs. Thirteen (41%) of these nest sites had been recorded in previous surveys and the remainder were "new sites" detected during travel between the known sites. The number of new nesting sites detected was surprising as the Burrowing Owl has generally been considered a species that returns to traditional nesting sites (Wedgwood 1976, 1978). Whether these new sites were recent shifts in breeding locales or "old" sites not detected during previous surveys could not be determined.

Burrowing Owl populations are decreasing in Canada (Wedgwood

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1978) and may be decreasing in some regions of the United States (Zarn 1974). One obstacle to management of this species is the difficulty in detecting Burrowing Owls to obtain population size and distribution data. Thorough foot searching of Burrowing Owl habitat (Zarn 1974) is very time consuming.

Roadside surveys have been used to estimate numbers and document trends of diurnal raptors (Craighead and Craighead 1956, Fuller and Mosher 1987, Woffinden and Murphy 1977). This method has also been used to estimate numbers of Burrowing Owls (Coulombe 1971, Ross 1974, Wedgwood 1976), which are diurnal hunters during the breeding season. Detailed breeding biology studies and precise population estimates require more effective methods of detecting owls and estimating their numbers.

Tests with various species of woodland raptors have shown that the use of recorded calls can increase the number of contacts (Gerhardt 1991, Mosher et al. 1990, Rosenfield et al. 1988). Here we evaluate the use of recorded calls in surveying for Burrowing Owls in southcentral Saskatchewan. Burrowing Owls are a good subject for this type of survey because the owls and their nest burrows are often easily seen from roadsides in this portion of their Canadian range. The objectives of our study were 1) to determine if Burrowing Owls would respond to broadcasts of conspecific calls, 2) if they did respond, determine if the broadcasting of calls improved our ability to detect owls, and 3) to evaluate the behavioral responses of owls, if any.

STUDY AREA AND METHODS

The study area was located in southcentral Saskatchewan, approximately 100 km south of Saskatoon. Intensive cultivation of cereal grains occurs throughout this area, and native grasslands and most pasturelands are uncommon and generally restricted to areas with stony soils, excessive slopes or poor soil moisture.

Survey routes.—Two survey routes, each with eight observation sites, were selected for study in 1982 and 1983. Each observation site had one or more active nest burrows in 1981 and was accessible by vehicle. To avoid vehicle noise and other vehicle interference we selected only sites that were not along or near a main highway. A western route was 62 km long and an eastern route was 53 km long. The observation sites for each route were not located at regular intervals along the survey route because Burrowing Owl habitat was irregularly dispersed throughout the study area.

Calls and equipment.—Burrowing Owls produce a variety of calls (Martin 1973). The primary song is considered the mate attraction and territorial call, is given only by the male, and was used for our surveys. It is described as "coo coo," two notes of equal frequency with the second note longer than the first. Other calls include distress, warning and copulation calls. The primary song of a male Burrowing Owl was originally recorded with a Uher 4000 Report-L tape recorder and Uher M-514 microphone at 19 cm/s (Martin 1973). For this study it was copied onto

a cassette tape and broadcast with a Marantz Superscope cassette player, a Realistic PA amplifier and an 8-ohm full range speaker, all powered by our vehicle battery. Past experience in our area indicated that Burrowing Owls are difficult to detect beyond 300 m in pastures strewn with stones and cow dung. Broadcast volume was adjusted to ensure that a clear rendition of the primary song was delivered to this distance. Each broadcast was a 1-min "call period" consisting of six primary calls spaced at 10-s intervals.

Survey timing and frequency.—In both 1982 and 1983 the use of calls was tested from early May, when owls arrived on the nesting sites, to the hatch period in mid-June. Each census route was traveled at least once weekly, and on alternate weeks in 1982 we conducted a morning census, which began at sunrise and an evening census that began 4 h before sunset. In 1982, 11 surveys were conducted, five on the eastern survey route and six on the western route. In 1983, eight surveys were conducted, three on the eastern route and five on the western route.

Survey procedures.—We parked our vehicle along the roadside to give us an unobstructed view of the observation site. The observation period lasted 20 min and was divided into two phases. The initial 10 min involved scanning the observation site with binoculars and a 20× spotting scope. At the end of this period, without exiting the vehicle, the speaker was placed on the roof, pointing toward the observation site, and a 1-min broadcast of six calls was played. This broadcast was repeated after 5 min. During and after each broadcast the observation site was scanned for owl activity and behavioral responses. The elapsed time from the onset of the broadcast to any behavioral response was recorded. The vehicle was driven to the next observation site and the entire procedure repeated. Each week the observation sites were checked on foot to determine the number of nesting pairs present. The census route was not run when winds exceeded 20 km/h or during heavy rain. Light winds and drizzle did not appear to depress the behavioral response of the owls to the broadcast calls.

Classification of owl responses.—Behavioral responses of male Burrowing Owls during territorial disputes include the territorial posture (described as courtship posture in Butts 1973 and Columbe 1971), bobbing, flying, the "white-and-tall' stance, and copulation (Butts 1973, Columbe 1971, Martin 1973, Thomsen 1971). Vocalizations often accompany these displays and consist of either repeated use of the primary song or the "chuck-and-chatter" call. Only the male owl gives the primary song. Female Burrowing Owls display much less during territorial disputes, occasionally uttering the "chuck-and-chatter" call, bobbing, flying to the nest burrow or engaging in copulation. Difference in plumage coloration, with males being lighter and less heavily barred (Grant 1965), was used to differentiate sex only in conjunction with the above behavioral displays. Owls that assumed an erect, alert and vertical posture, and aggressively engaged in one of the typical male displays described above, were considered to be male owls. Owls that assumed a more horizontal position and did not engage in territorial posturing, were considered to be female

owls. In most cases both owls of a pair were visible after the call, and these differences in behavior facilitated identification of sex. When only one owl was visible, and its response to the calls was not clearly indicative of either a male or female, the sex of the owl was classified as unknown.

Linear regression was used to determine changes in owl response rates over time. A t-test was used to determine if differences in response rates occurred between morning and evening surveys.

RESULTS

Response rate.—Response rates of owls to the broadcast calls were evaluated for only those owls that were visible prior to the first call period (Table 1). Fifty-seven percent of all owls (males, females and owls of unknown sex) were observed to respond to the broadcast of the primary call. Of the owls that could be sexed by behavior, 84% of the males and 29% of the females responded. These latter rates are overestimates to some degree as those male and female owls that did not respond at all were classified as unknown sex.

There was a significant decline ($b = -1.21$, $r^2 = 0.419$, $P = 0.003$) in the response rate of all owls (males, females and unknown sex combined) during the survey period from 29 April to 13 June. The response rate of all owls ranged from 68 to 100% during the first 20 d of this 50-d survey period, and from 0 to 67% during the last 20 d. The lesser rate of decline in response rate of male owls during this period was not significant ($b = -0.68$, $r^2 = 0.131$, $P = 0.129$), although sample size was small, with 78–100% of male owls responding during the first 20 d, and 67–86% during the last 20 d of the survey period. Small sample sizes prevented similar regression analyses for female owls and unknown sex owls. The response rate of female owls varied from 50 to 100% during the first 10 d and from 0 to 50% for the remainder of the survey period.

There was no significant difference in the response rate of all owls (male, female and unknown sex combined) between morning surveys (4 h after sunrise) and evening surveys (4 h prior to sunset) ($t = 0.871$, 9 df, $P = 0.406$).

Types of response.—The most frequent behavioral response exhibited by male owls was the territorial posture with the issuing of the primary call (64% of 196 observations). In a few cases (4%), we heard the primary call even though the male owl was not visible. The second most frequent response of male owls was flight to the female, to the nest burrow or to a nearby fencepost, where the territorial posture was often displayed (20%). The other three male responses, "white-and-tall," copulation, and alarm bobbing were each far less frequent ($\leq 5\%$). Female owls visible prior to the broadcast exhibited few responses other than an occasional bobbing, issuing of the "chuck-and-chatter" call or, rarely, engaging in copulation.

Detection of owls.—A greater number of both male and female owls were detected after the primary song was played (Table 2) than during the initial observation period. For 1982 and 1983 combined the increase in number of owls detected was 53% for all owls, 38% for male owls and

TABLE 1. Number of Burrowing Owls that actively responded to the broadcasting of tape-recorded primary calls, 1982–1983.

	1982		1983		Total	
	Observed*	Respond	Observed*	Respond	Observed*	Respond
Sex	#	%	#	%	#	%
Male	91	81	52	88	143	84
Female	43	19	23	48	66	29
Unknown	30	10	18	22	48	15
Total	164	52	93	66	257	57

* Includes only those owls detected prior to broadcasting of calls.

100% for female owls. Fifty percent of the 132 female owls recorded during all surveys were detected when they appeared at the mouth of a nest burrow after the broadcast. In 50 cases where only a single owl was visible before we broadcast the primary call, we confirmed the presence of pairs when the female was detected at the burrow entrance immediately after the call. Similarly, in 16 cases where no owls were initially visible, we confirmed the presence of pairs when both owls were detected after the call. This increased detection of female owls resulted in confirmation of all nesting pairs after three surveys by the third week of May of each year.

DISCUSSION

It is apparent that the use of broadcast calls greatly enhanced our ability to detect the presence of nesting owls. A greater number of owls was detected after the broadcast for every survey conducted. Overall 53% more owls, including males, females and owls of unknown sex, were detected after the broadcast with 57% of all owls responding to the broadcast calls. As owls of unknown sex were those which did not respond in a manner which indicated sex, male (84%) and female (29%) response rates were overestimated to some degree.

This enhanced ability to detect owls was likely related to the immediate and active responses of owls to the broadcast calls. Male owls in particular

TABLE 2. Number of Burrowing Owls detected before and after the broadcasting of tape-recorded primary calls, 1982–1983.

	1982		1983		Total	
Sex	Before	After*	Before	After*	Before	After*
Male	91	129 (42)	52	69 (33)	143	198 (38)
Female	43	85 (98)	23	47 (104)	66	132 (100)
Unknown	30	38 (27)	18	24 (33)	48	62 (29)
Total	164	252 (55)	93	140 (51)	257	392 (53)

* Percent increase in parentheses.

were very responsive and reacted immediately to the calls by singing the primary song, bobbing or flying toward the source. Erection of the covert feathers in the throat, upper breast region, and eyebrows, during the territorial posture and "tall-and-white" responses, resulted in a very "bright" patch, which assisted in detection. Female owls were less responsive, generally remaining alert but motionless, watching the male. Many female owls were detected when they emerged from burrows and were visible at the burrow entrance after the broadcast. This response assisted in confirming the presence of breeding pairs rather than single owls at all nest sites during the census seasons.

This technique appeared to be equally effective during both early morning and evening when enough light was available. High wind speed, disturbance due to traffic, and heat wave distortion are generally less frequent in the morning period and surveys may be more effective at this time. Surveys conducted before sunrise or after sunset may underestimate the number of nesting owls because at these times male owls may be foraging away from the nest burrows (Haug and Oliphant 1990).

Response rates of owls declined throughout the survey period. Our sampling design cannot determine whether this decline can be attributed to habituation of owls to the broadcasts or to an actual decline in territorial response of the owls. Although the response rate of male owls declined during the survey period it was still 67–87% during the first 2 wk of June. This suggests the technique may be effective in enhancing detection of male owls throughout the incubation period. Female owls became less responsive after the third week of May and this may represent active incubation of eggs by the female owls within their nest burrows during this time.

In many habitat situations, relief, presence of boulders or cow dung, and vegetation height can limit visual detection distances of owls to less than 300 m. Burrowing Owls often perch near the immediate burrow entrance, which may result in the burrow mound itself partially screening the owl(s) from view. These local circumstances affect the results of roadside surveys and must be considered.

We recommend that three surveys be conducted, perhaps 5–7 d apart. to detect female owls should they emerge from the burrow in response to the call. These surveys should begin within 1 wk of the arrival of the owls at the nesting area. The user should be aware that habituation to the calls may occur if surveys are frequent.

Our study suggests that the use of broadcast calls can enhance detection of Burrowing Owls on a given site should they be present. The term enhance is an important distinction because this technique will not guarantee detection of all owls present at a given site during a given survey. Some owls might not respond, or respond very little, during a given survey. This reduced detection is particularly true with female owls, which may respond by emerging from the burrow, yet remain still and partially screened by the burrow mound. Owls in these situations are difficult to detect, particularly if the burrow mound is vegetated and not immediately

evident to the observer. This technique appears to be a useful tool for improving the efficiency of Burrowing Owl surveys, however. Further investigation of the role of habituation of owls to broadcast calls versus a waning of territorial responses would be of interest.

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