2002

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Recommended Citation

Johnson, J. B., D. Saenz, D. B. Burt and R. N. Conner. 2002. An automated technique for monitoring nocturnal avian vocalizations. Bulletin of the Texas Ornithological Society 35:24-29.

AN AUTOMATED TECHNIQUE FOR MONITORING NOCTURNAL AVIAN VOCALIZATIONS

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ABSTRACT.—We used audio recording dataloggers known as Frogloggers to collect nocturnal bird vocalizations at eight different sites within the Davy Crockett National Forest and the Stephen F. Austin Experimental Forest in eastern Texas from 9 May 2000 to 31 June 2001. We programmed the dataloggers to record for one-minute intervals at the beginning of each hour starting at 2100 and ending at 0200 DST, for a total of six minutes at each site per night. Data were collected simultaneously every night, which would not have been possible using traditional bird surveying techniques. We detected vocalizations of a variety of nocturnal and diurnal species. Our technique has the potential to allow determination of the relative seasonal occurrence of nocturnally vocalizing avian species because we were able to survey every night of the year. This technology, originally developed for amphibian surveys, is proving quite useful in its application to avifauna.

Nocturnal bird surveys are relatively uncommon compared with diurnal surveys. When they are conducted, the focus is generally on a particular species or group of species (i.e., owls). This paucity of nocturnal surveys is probably related to the difficulty in conducting fieldwork with inadequate light, the relatively few species that vocalize at night, and a low detection rate for these innumerous species.

Specialized needs of some surveys (e.g., nocturnal bird surveys) may call for the utilization of specialized tools to maximize efficiency and limit bias. For example, surveyors should be open to employing new techniques in order to budget surveying time appropriately and to maximize the detection of rare vocalization events. Also, new methods may be applicable in surveying multiple locations at the same time and by a limited number of individuals, thereby limiting bias. Automated recorders, termed Frogloggers, have been utilized to monitor anuran vocalizations (Peterson and Dorcas 1994; Bridges and Dorcas 2000); and could prove useful in monitoring avian vocalizations.

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[2] Maintained in cooperation with the College of Forestry, Stephen F. Austin State University, Nacogdoches, TX.

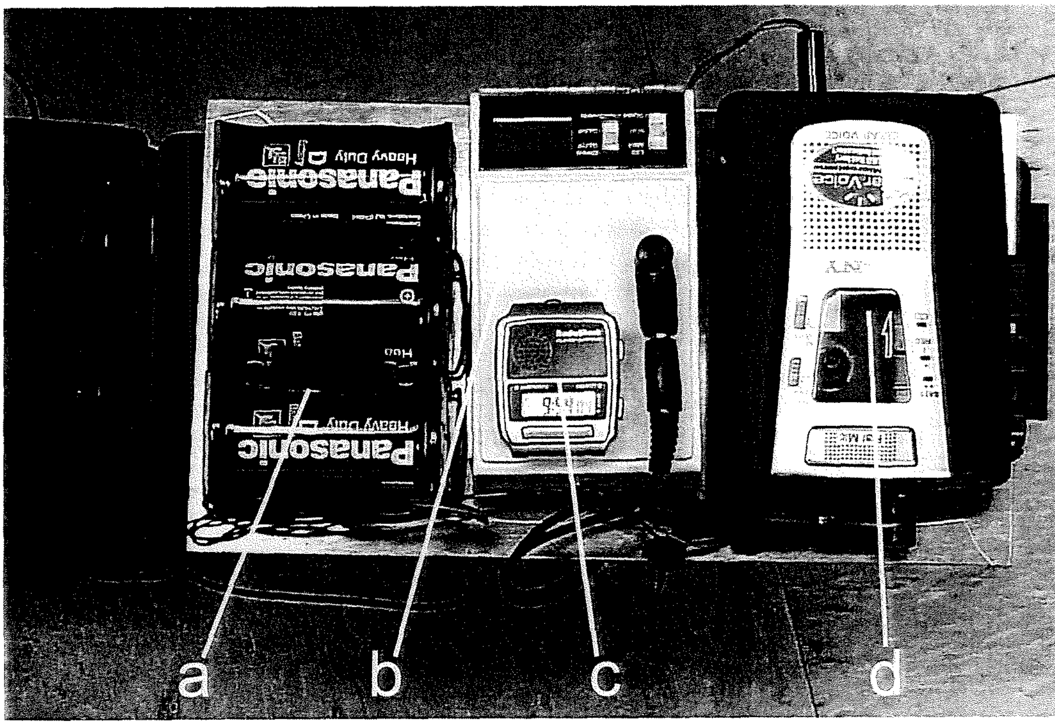

Figure 1. The internal components of the dataloggers. a batteries, b timer, c talking watch, and d tape recorder.

Many bird species respond to vocalizations from other individuals of the same species, this phenomenon has been utilized for surveys; for instance owl surveys are conducted by broadcasting the call of a taped individual to illicit a response (Bibby et. al. 1992). However, in surveys conducted to monitor vocalization patterns or some other aspect of avian vocalizations this may be undesirable (a potential source of bias) if disturbance by the surveyor were to result in a vocal response by the birds. Kloubec and Capek (2000) conducted a study of the singing activity of Marsh Warblers (*Acrocephalus palustris*) in Europe, and noted that vocalization from males can result from disturbance (they give the example of surveyors walking noisily) which in their study was undesirable and was remedied by running the survey line along a dam. This was done to lessen the amount of noise generated by the surveyors because of dense vegetation surrounding alternate routes. With a species such as the Marsh Warbler and its possible bias with relation to disturbance, utilization of a non-intrusive method such as our dataloggers might be a logical consideration.

The primary objective of this study was to determine the utility of this technique in monitoring the presence or absence of nocturnally vocalizing avian species. Secondarily, we wanted to determine the seasonality and rate of nocturnal avian vocalizations in eastern Texas.

STUDY AREAS AND METHODS

We recorded nocturnally vocalizing birds at eight sites in the Davy Crockett National Forest (n = 4) and the Stephen F. Austin Experimental Forest (n = 4) in eastern Texas. Each study site was located in secondary growth upland loblolly (*Pinus taeda*) and/or shortleaf (*P. echinata*) pine forest. Each site was immediately adjacent to a manmade pond constructed for wildlife habitat improvement.

The dataloggers used in our study are composed of a standard cassette recorder (Fig. 1d), a six-cycle timer (six on/off cycles per 24 hours) (Fig. 1b), a voice clock (talking watch) (Fig. 1c), three D-cell batteries (Fig. 1a), and a dynamic microphone (Fig. 2c). The components are linked via a custom built circuit board that allows the timer to activate and deactivate the recorder, microphone and voice clock simultaneously at predetermined time intervals selected on the timer. All components except the microphone are housed in a weatherproof army ammunition box (Fig 2a). The microphone wire (Fig. 2b) extrudes through a hole drilled in the side of the box that is sealed with silicon to prevent moisture from entering the box and damaging the electronic components. The recorders were used to monitor the eight study sites in eastern Texas every night for more than 13 months.

Dataloggers were placed near the eight small manmade ponds (one per pond) with the microphone orientated toward the pond from 9 May 2000 to 31 June 2001 and were programmed to simultaneously record at each site every night for one minute at the start of each hour beginning at 2100 and ending at 0200 DST. Each week the tapes were retrieved from the field and the vocalizations were documented.

RESULTS

We recorded nine species of nocturnally vocalizing birds during our 13 month study period. Species detected were Chuck-will's-widow (*Caprimulgus carolinensis*, n = 554), Barred Owl (*Strix varia*, n = 83), Yellow-breasted Chat (*Icteria virens*, n = 78), Yellow-billed Cuckoo (*Coccyzus americanus*, n = 50), Eastern Screech-Owl (*Otus asio*, n = 15), Great Blue Heron (*Ardea herodias*, n = 6), Snow Goose (*Chen caerulescens*, n = 10, as flyovers), Great Horned Owl (*Bubo virginianus* n = 1), and Northern Cardinal (*Cardinalis cardinalis* n = 1).

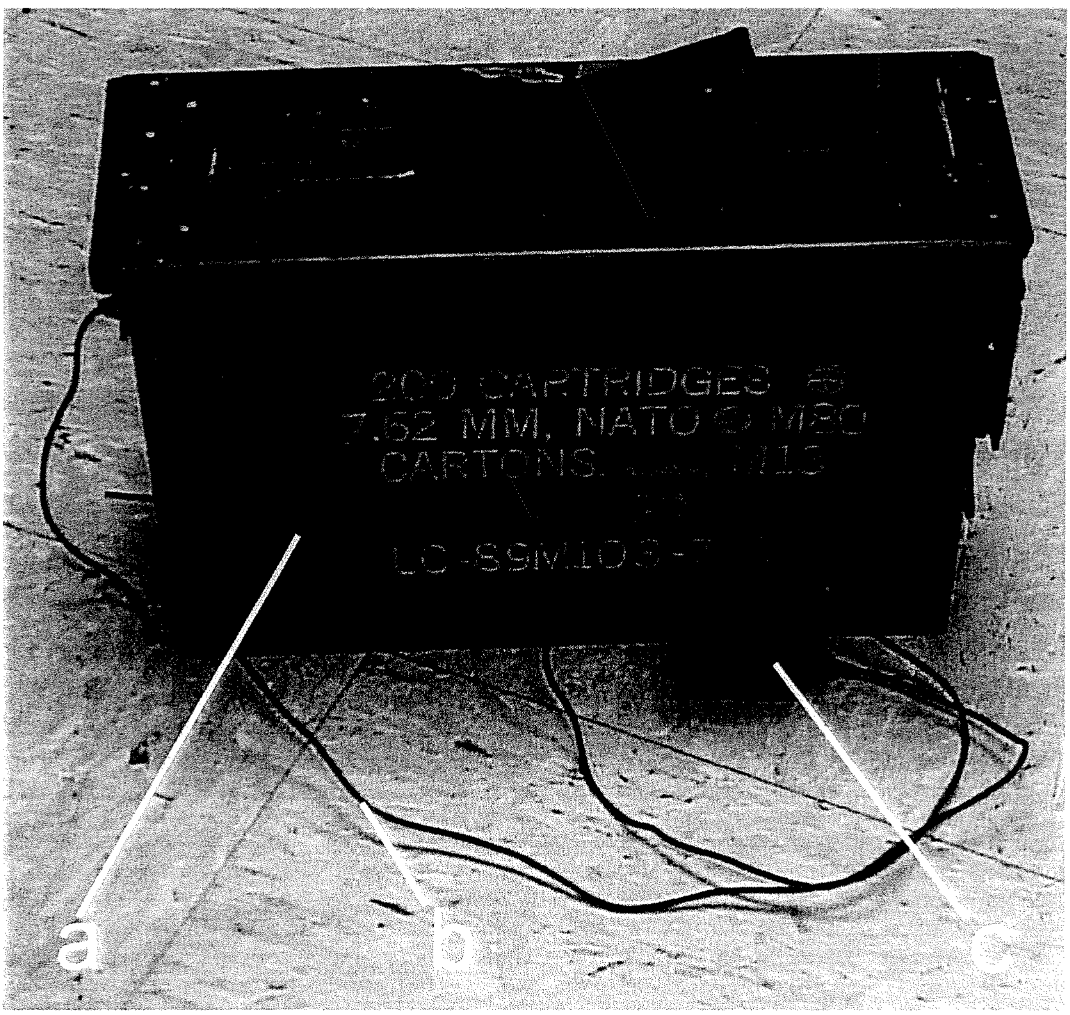

Figure 2. The external components of the dataloggers. a ammunition case housing, b microphone wire, c microphone.

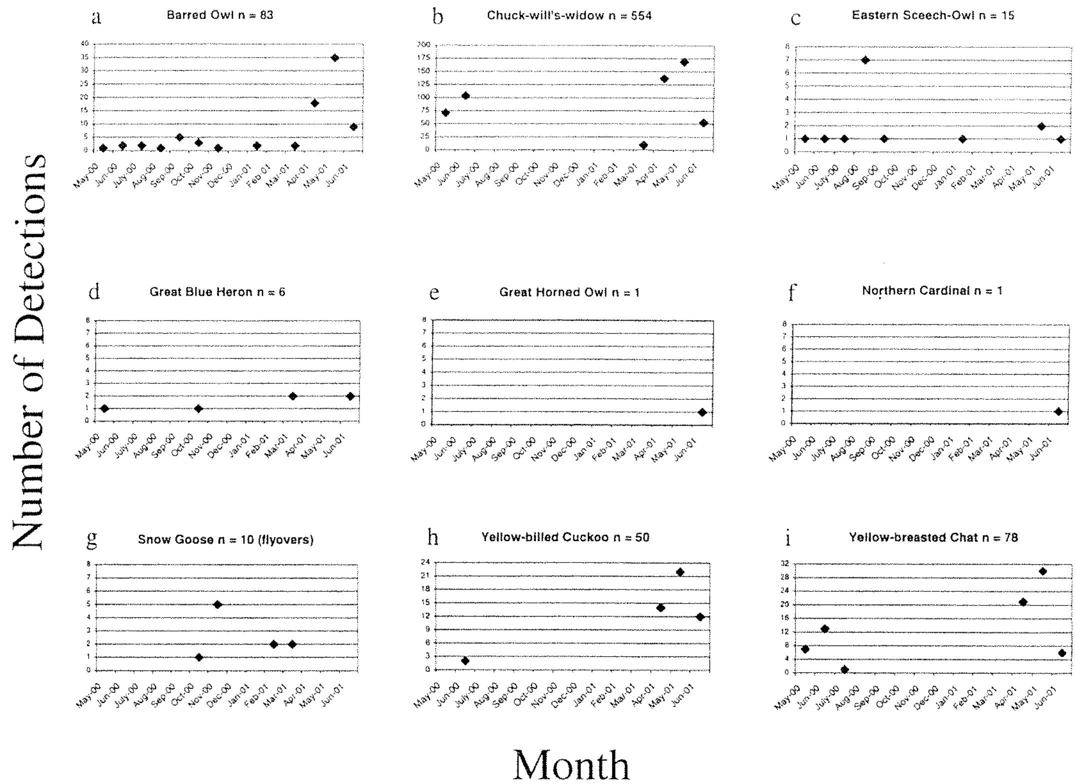

Figure 3. Number of detections for each species by month.

As would be expected, the Neotropical migrants such as the Chuck-will's-widow, Yellow-billed Cuckoo, and the Yellow-breasted Chat were only detected from March to June (Fig. 3b, 3h, 3i, respectively). Barred Owls were detected infrequently until April of 2001 when the number of detections dramatically increased to a maximum in May (Fig. 3a). Snow Geese were detected as flyovers, during fall and spring migration (Fig. 3g). The detection of Eastern Screech-Owls was low and unpredictable (Fig. 3c). Great Blue Herons were detected in low numbers but could have been attracted to the ponds (Fig. 3d). We detected Northern Cardinal and Great Horned Owl only once each (Fig. 3f, 3e, respectively).

DISCUSSION

Our automated recorders were able to detect avian vocalizations. This technique permitted us to survey all of our locations at exactly the same time, something that would be impossible with other avian census techniques. We were able to listen to and transcribe tapes at our convenience so scheduling was not a problem.

This method resulted in 334.4 hours recorded, and in that span of time, only one Northern Cardinal and one Great Horned Owl were detected. A point count survey would have had a lower probability of detecting these birds due the limited sampling events typically associated with this method.

The Chuck-will's-widow was the most commonly detected bird species (n = 544), which is likely a reflection of this species nocturnal habits. Yellow-breasted Chats and Yellow-billed Cuckoos are generally considered diurnal, but nocturnal behavior has also been noted (Bent 1939). The detection of these three Neotropical migrant bird species reveals seasonal patterns that reflect the timing of their migratory behavior (Fig. 3b, 3i, 3h, respectively). Snow Geese are Nearctic migrants and often start their migration after sunset and continue through the night and into the daylight hours (Bellrose 1976). All occurrences of Snow Geese were detected as flyovers. Presumably, their arrival for fall migration can be observed starting in October and November with spring migration in February and March (Fig 3g). Our nocturnal taping technique has the ability to precisely determine the arrival and departure dates for migrant species.

The Barred Owl is a resident species in eastern Texas and was detected in consistently low numbers each month until the spring of 2001 when nocturnal vocal activity increased markedly in May (Fig. 3a). The bulk of the Barred Owl detections for this time span were made at two locations that are relatively close to one another. Each of our survey sites was fixed throughout the study, which suggests that the majority of these vocalizations were made by a relatively small number of owls. This species is regarded as one of the more vocal owls of North America (Mazur and James 2000). Barred Owls often increase their vocalization rate in efforts to establish territories (Johnsgard 1988); hence, the increase in our detections could be the result of territorial activity.

Use of automated dataloggers to detect avian vocalizations has some disadvantages. For instance, one cannot use this technique to conduct an exact population survey because there is no way of determining if a bird detected in one sampling period was the same in a previous or subsequent period. At best, this technique allows the observer to take note of presence or absence. Each detection may not be independent from the previous or subsequent detections; this may be responsible for the numerous detections of Barred Owls during May of 2001.

Financial restrictions of using dataloggers can limit the number of survey sites, as a single datalogger costs approximately $300 for a field-ready unit. Equipment failure is a potential problem in consecutive nightly sampling. Therefore, we recommend that backup recorders be kept available. If a qualified individual initially constructs the recorders, then failure should be at a minimum. We have noted problems with batteries at subfreezing temperatures. Theft can also be a potential problem; to date we have lost one recorder, which has forced us to begin burial of our dataloggers for concealment.

Variation in detection rates and abilities among observers can bias bird surveys. Sauer et al. (1994) found that population fluctuations in the Breeding Bird Survey could be directly attributed to changes in the individuals conducting the surveys. The datalogger technique does remedy some of these problems by letting one person do all the detections and by providing the surveyor with a means of repeatedly reviewing a segment of tape to better clarify its vocalizing avian composition. It allows the surveyor to refer to a reference vocalization, which would be impractical in a traditional survey. Using automated recorders, the number of observers can be kept to one or a few individuals. In addition, multiple locations can be monitored simultaneously, whereas point count techniques require the surveyor to move from one site to the next and sites are surveyed at different times. This has two potential weaknesses. First, time of day is known to influence bird vocalization activity (International Bird Census Committee 1970; Conner and Dickson 1980), and second, the sites may not be considered independent because of the delay in moving from one location to the next by the surveyor and the ability of the bird to relocate to the surveyor's next site.

Automated recorders have the potential to increase the effectiveness of nocturnal bird surveys and in specialized instances, diurnal surveys. The application of this technique could prove useful in many situations where traditional bird surveys may be impractical. However, it is a specialized tool that may not be practical for all monitoring programs, most notably with population estimates. Our technique might be especially useful for determining presence or absence in rugged terrain or remote areas, or for long-term studies requiring continuous sampling such as effects of global climate change in relation to timing of migration activity.

ACKNOWLEDGEMENTS

We thank C. E. Shackelford, K. A. Baum, and C. K. Adams for offering valuable suggestions to this manuscript. We would like to also thank K. A. Baum and S. L. Crook for transcribing tapes.

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SHORT COMMUNICATIONS

DEPREDATION OF TEXAS WHEAT BY MIGRATING DICKCISSELS

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The Dickcissel (*Spiza americana*) is a serious agricultural pest on its wintering grounds in Venezuela. Enormous flocks containing thousands of birds often destroy fields of rice and sorghum (Basili and Temple 1995). And, although it would be expected that this same behavior would be manifest by flocks during their northward migration, there seems to be only a single report in the ornithological literature, i. e., millions of Dickcissels depredating on wheat in the "milk" stage of grain development in Sinaloa, Mexico, during February through mid-April 1963 (Monson 1997).

For over 40 years during the 19th century enormous flocks of what were referred to by the media as "wheat birds" migrated through Texas causing great damage to the developing wheat. In 1885, Henry F. Peters, a long-time resident and station observer at Bonham for the Mississippi Valley Migration Study, identified these mysterious birds as Black-throated Buntings, a former name for the species now called the Dickcissel. According to Peters, Black-throated Buntings were "the pest and dread" of Texas farmers and when they settled into a field "it was a hard matter to drive them away until they had destroyed it" (Peters 1885). This note will describe crop depredation by Dickcissels and the efforts of Texas farmers to protect their fields from marauding flocks during the years 1849 through 1891.

Wheat was first grown commercially in Grayson County about 1833 and by 1858 production in northeastern Texas was an estimated 3.5 million bushels (Anon. 1858a). Production in 1867 was six million bushels and by 1879 an estimated 104,000 acres were planted in wheat (Hartmann 1996). The crop was planted from September through November and produced its vegetative growth during the winter months. Maturation of the grain occurred during late April and May, a period coinciding with the spring passage of Dickcissels through the state.

Dickcissels were first seen at Dallas during the spring of 1849 when they "appeared in myriads, and destroyed the wheat crop almost without exception." An anecdotal account of the 1849 invasion describes a

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