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EXTINCT AND EXTIRPATED BIRDS OF TEXAS

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ABSTRACT.—Twenty-four species or subspecies, some based on isolated skeletal fragments and of questionable status, have been reported from paleontological and archeological sites in Texas. One species dates from the Late Triassic, 3 from the Cretaceous, 7 from the Pliocene, 8 from the Pleistocene and 5 from the Holocene. Two species, the Passenger Pigeon and Carolina

California Condor (*Gymnogyps c. californianus*) once flew over the peaks and canyons of Brewster county, Texas. Photo F Truslow@VIREO

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Parakeet, became extinct within historic times. Species associated with a terrestrial habitat are more heavily represented than those associated with an aquatic habitat. The metatarsus of a young California Condor barely able to fly suggests that this species once nested in Texas. *Titanis* represents the only flightless bird recorded in Texas and *Protoavis,* if accepted as a bird, represents the oldest avian form yet discovered.

The first checklist of Texas birds was published by L. R. Wolfe in 1956. This list was subsequently revised in 1974 under the auspices of the Bird Records Committee of the Texas Ornithological Society and has since passed through two additional editions (1984 and 1995). An appendix in each of these editions lists those species that have become extinct or extirpated within historic times. This paper adds to previous lists by including extinct species from earlier geological ages, along with comments regarding their taxonomy and distribution. Binomial and vernacular names of living and recently extinct species follow *The Check-list of North American Birds* (A.O.U. 1998) and its supplement (A.O.U. 2000). Vernacular names of paleospecies are based on the derivation of their specific epithets and the morphology of their remains. Ages of the geological epochs mentioned in the text are as follows: Holocene, present to 11,000 years before present; Pleistocene, 11,000 to 1.8 million years before present (MYBP); Miocene, 5-23 MYBP; Oligocene, 23-38 MYBP; Eocene, 38-54 MYBP and Paleocene, 54-65 MYBP.

Ornithothoraces. A cladistic group characterized by a supracoracoideus pulley, keeled sternum, springlike furcula, flapping flight, and the capability of taking off from the ground (Chatterjee 1997).

Protoavis texensis Chatterjee 1991. Extinct. Holotype and paratype from Late Triassic deposits at the Post Quarry in Garza County. Additional postcranial elements recovered from the Kirkpatrick Quarry in Crosby County. Age of deposits estimated to be about 225 million years before present (MYBP) thus making *Protoavis* at least 75 million years older than *Archaeopteryx.* Pheasant-size with a long bony tail and toothed jaws. Feather impressions not found but "quill knobs" on the metacarpals are believed to indicate the presence of feathers on the living animal (Chatterjee 1991, 1995, 1997). Critics maintain that *Protoavis* is a mixture of the remains of two or more non-avian species, i.e., it is a chimera and not a valid species (Witmer 2001).

Order Ichthyornithiformes

Ichthyornis dispar Marsh 1872. Toothed Cretaceous Bird. Extinct. Holotype from Kansas. The name *dispar* "different" denotes the distinctiveness of the species. Specimens believed conspecific have been recovered from the Ector Chalk Formation of the Austin Group at Savoy Pit, Fannin County, Texas (Parris and Echols 1992).

Ichthyornis antecessor (Wetmore 1962). Toothed Cretaceous Bird. Extinct. Holotype from Kansas. The name *antecessor* "forerunner" denotes the ancestral status of the species. This species was originally placed in the genus *Plegadornis* and then transferred to *Angelinornis* before being assigned to *Ichthyornis* (Olson 1975). Texas specimens have been recovered from the Pflugerville Formation on Little Walnut Creek in Austin, Travis County, and from an unnamed tributary of the North Sulphur River near Gober in Fannin County (Parris and Echols 1992).

Ichthyornis lentus (Marsh 1877). Toothed Cretaceous Bird. Extinct. Identification based on the distal portion of a tarsometatarsus from the Cretaceous Austin Chalk near McKinney in Collin County, Texas. Although Marsh (1877) thought the specimen was from an extinct cormorant and described it as *Graculavus lentus*, he soon transferred the species to *Ichthyornis* (Marsh 1880).

A later comparison by Shufeldt (1915) of the type specimen with the tarsometatarsi of various galliforms indicated that it most closely resembled that of the Sharp-tailed Grouse (*Tympanuchus phasianellus*). This identification is undoubtedly erroneous since the first recognizable galliforms do not appear in the fossil record until the Lower Eocene (Feduccia 1996:260). Recent workers have questioned the taxonomic identity and geological age of the holotype (Parris and Echols 1992).

Order Ciconiiformes

Plegadis pharangites Olson 1981. Canyon Ibis. Extinct. Originally described as *Plegadis gracilis* from the Late Pliocene (Blancan) of Cita Canyon, Randall County, Texas (Miller and Bowman 1956a). The name *pharangites* "chasm or ravine" denotes the type locality. Radiometic age of the Cita Canyon deposits about 2.5 MYBP (Becker 1987). Also known from Pliocene sites in Kansas and Florida (Becker 1987).

Coragyps atratus occidentalis (Miller 1909). Western Black Vulture. Extinct. Originally described as *Catharista occidentalis* from the Upper Pleistocene of Rancho La Brea, California. Considered to be a temporal subspecies of the Black Vulture from which it differs by being slightly larger in size (Steadman et al. 1994). A specimen referable to this taxon has been recovered from Friesenhahn Cave in Bexar County, Texas. Additional Pleistocene records from Nevada, New Mexico, Florida and Nuevo Leon, Mexico, as well as a Holocene record, circa 8000 years before present (YBP), from Oregon (Brodkorb 1964a).

Gymnogyps californianus amplus (Miller 1911). Greater California Condor. Extinct. Originally described as *Gymnogyps amplus* but now considered to be a temporal subspecies of the California Condor, *Gymnogyps californianus*, from which it differs in details of the skull and a larger average size (Brodkorb 1964a, Emslie 1988, Snyder and Snyder 2000). Holotype from Pleistocene deposits in Samwel Cave, Shasta County, California. Additional Pleistocene records from Florida, Nevada, Arizona, New Mexico, and Nuevo Leon, Mexico. A specimen referable to this subspecies has been recovered from Friesenhahn Cave, Bexar County, Texas (Brodkorb 1964a).

Gymnogyps californianus californianus (Shaw 1798). California Condor. Extirpated. Remains representing at least three individuals recovered from a cave on the south peak of Mule Ears Peaks in Brewster County, Texas. A metatarsus from a young bird barely able to fly provides evidence of nesting in the vicinity. The bones from Mule Ears Peaks were originally believed to be between 1500 and 3000 years old based on the presence of human cultural remains (Wetmore and Friedmann 1933) but have now been radiocarbon dated at circa 12,580 YBP (Emslie 1987). A humerus from Maravillas Canyon in Brewster County has been dated at about 10,215 YBP (Emslie 1987).

Order Anseriformes

Anas bunkeri (Wetmore 1944). Bunker Teal. Extinct. Holotype from the Upper Pliocene of Kansas. named for Charles D. Bunker in recognition of his work at Kansas State University Museum of Natural History. Similar to, but slightly larger than the present-day Green-winged Teal, *Anas crecca*. A specimen from the Middle Pliocene in Hemphill County, Texas, originally identified by Compton (1934) as belonging to a Green-winged Teal, was later referred by Brodkorb (1964a) to this species. The species is also known from the Middle Pliocene of Oregon and the Lower Pleistocene of Arizona and Idaho (Brodkorb 1964a).

Anabernicula gracilenta Ross 1935. Gracile Shelduck. Extinct. Known from the Upper Pleistocene in California, Nevada, New Mexico and Groesbeck Creek in Hardeman County, Texas (Brodkorb 1964a). The name *Anabernicula* "duck-goose" indicates the relationship of the genus while *gracilenta* denotes the delicacy and grace suggested by features of the specimens (Ross 1935).

Oxyura bessomi Howard 1963. Bessom Stiff-tailed Duck. Extinct. Holotype collected by Leonard C. Bessom from Middle Pleistocene deposits along Vallecito Creek, Anza-Borrego Desert, San Diego County, California. Specimens referable to this species have also been recovered from the Seymour Formation of the Middle Pleistocene on the O. L. Patterson Ranch in Knox County, Texas (Brodkorb 1964a).

Order Falconiformes

Caracara cheriway prelutosus (Howard 1938). Rancho La Brea Caracara. Extinct. Holotype from Rancho La Brea, California. Originally described as *Polyborus* (=*Caracara*) *prelutosus* based on the presumption that it was the ancestor of the Guadalupe Caracara, *Caracara lutosus,* which became extinct in the early 1900s (Abbott 1933). The Rancho La Brea Caracara is now considered (e.g. Harris 1992) to be a temporal subspecies of the Crested Caracara, *Caracara cheriway,* from which it differs by being smaller in average size and having shorter legs and a broader, shorter beak (Howard 1938). Specimens believed conspecific have been recovered from the Seymour Formation of the Middle Pleistocene near Gilliland, Knox County, Texas, and from Upper Pleistocene deposits in Friesenhahn Cave in Bexar County, Texas. Also known from sites in New Mexico and Florida (Brodkorb 1964a).

Order Galliformes

Tympanuchus ceres (Shufeldt 1913). Ceres Prairie-Chicken. Extinct. Holotype originally believed to be a species of either *Bonasa* or *Lagopus.* Named for Ceres, an ancient Italian goddess of agriculture. The type material from Conrad Fissure, Newton County, Arkansas was later restudied by Wetmore (1959) who placed the species in *Tympanuchus.* The Ceres Prairie-Chicken was slightly smaller and had a heavier bill and shorter, smaller wings than the Lesser Prairie Chicken, *Tympanuchus pallidicinctus.* Specimens believed conspecific from Florida and the Upper Pleistocene of Dallas County, Texas (Brodkorb 1964a).

Meleagris leopoldi Miller and Bowman 1956. Leopold Turkey. Extinct. Originally reported as *Parapavo californicus* from the Pliocene of Cita Canyon, Randall County, Texas (Miller and Johnstone 1937). Later described as *Meleagris leopoldi* by Miller and Bowman (1956). Radiometric date of deposits about 2.5 MYBP (Becker 1987).

Meleagris anza Howard 1963. Anza Turkey. Extinct. Holotype from Arroyo Tapiado, Anza-Borrego Desert, San Diego County, California. Originally placed in the genus *Agriocharis* but later transferred to *Meleagris.* The proximal end of a femur believed conspecific has been recovered from the Seymour Formation of the Middle Pleistocene at Rattlesnake Point near Gilliland, Knox County, Texas (Brodkorb 1964b).

Order Gruiformes

Titanis walleri Brodkorb 1963. Waller Terror Bird. Extinct. The holotype of this large flightless predator was collected by Benjamin Waller from Pliocene deposits in Florida. A specimen believed conspecific has been recovered from the Sorensen Ranch sand and gravel pit in San Patricio County on the lowest terrace of the Nueces River. The age of the terrace is Late Pleistocene (Baskin 1995). *Titanis* is estimated to have stood two meters tall and weighed about 150 kg. The family Phorusrhacidae to which *Titanis* belonged was widely distributed throughout South America and the specimens from Florida and Texas represent its northernmost occurrence (Marshall 1994).

Creccoides osbornii Shufeldt 1892. Osborn Rail. Extinct. Holotype collected from Pliocene (Blancan) deposits in Crosby County, Texas, dated from 1.4 to 2.8 MYBP (Becker 1987, Johnston and Savage 1955). *Creccoides* means "crakelike" and the specific name honors the paleontologist Henry F. Osborn. The Osborn Rail was somewhat larger than a Limpkin (*Aramus*). The type can no longer be located and it has been suggested that *Creccoides* may not even be a rail (Olson 1977).

Order Columbiformes

Ectopistes migratorius (Linnaeus 1766). Passenger Pigeon. Extinct. Regular winter visitor in northeastern Texas, occasionally penetrating as far south and west as Bexar and Real counties. Breeding documented in Tyler County during 1887 (Casto 2001). Skeletal remains have been found at prehistoric archeological sites in Bowie and Red River counties and at six mid to late 19th century homestead sites in Dallas and Tarrant counties (Casto 2001). The last members of this species collected in Texas were taken on Upper Galveston Bay in 1900 (Oberholser 1974).

Order Psittaciformes

Conuropsis carolinensis (Linnaeus). Carolina Parakeet. Extinct. Formerly resident along the Red River in northeastern Texas with flocks occasionally wandering further south and west. Hundreds reported in Brown County during the summer of 1885. Reportedly bred in large numbers in Red River County prior to 1886. The last Carolina Parakeet was reportedly killed in Bowie County around 1897 (Oberholser 1974). Parakeets were undoubtedly collected by Native Americans for their colorful feathers and they were kept as cage birds by the early Texans. There are, however, no known records of parakeet remains from archeological sites in Texas.

Order Cuculiformes

Geococcyx californianus conklingi (Howard 1931). Conkling's Greater Roadrunner. Extinct. Holotype from late Pleistocene deposits of Conkling Cavern, Dona Ana County, New Mexico. Originally described as *Geococcyx conklingi* but now considered to be a temporal subspecies of the Greater Roadrunner (Harris and Crews 1983, Steadman et al. 1994). Additional late Pleistocene records from San Josecito Cave, Nuevo Leon, Mexico, and Dark Canyon Cave, Eddy County, New Mexico. A specimen from Holocene deposits in Pratt Cave, Culberson County, Texas, has been referred to this subspecies. Conkling's Greater Roadrunner was larger than the present-day Greater Roadrunner, perhaps as an evolutionary response to the cooler tem-

peratures of the Pleistocene and early Holocene. The subspecies is believed to have become extinct between 3,000 and 6,000 years ago (Harris and Crews 1983).

Order Piciformes

Campephilus dalquesti Brodkorb 1971. Dalquest Woodpecker. Extinct. Holotype from Upper Pliocene (early Blancan) deposits on the Beck Ranch about ten miles east of Snyder, Scurry County, Texas (Brodkorb 1971). named in honor of W. W. Dalquest in recognition of his work on the vertebrate paleontology of Texas.

Campephilis principalis (Linnaeus). Ivory-billed Woodpecker. Extinct? Once locally common in wooded bottomlands and swamps along rivers in east Texas. Last specimens taken in Liberty County in 1904 (Oberholser 1974). A list of Texas counties from which Ivory-bills have been reported is found in Shackelford (1998). In addition to these records, a carpometacarpus tentatively identified as that of an Ivory-bill has been recovered from a late 18th century archeological site in Limestone County (Yates 1993). If confirmed, this report will be a new county record for the species.

Order Passeriformes

Protocitta dixi Brodkorb 1957. Dixie Jay. Extinct. Holotype from the Illinoian Stage of the Pleistocene at the Dixie Lime Products Company, Reddick, Marion County, Florida (Brodkorb 1957). A specimen from Miller's Cave, Llano County, Texas has been referred to this species (Weigel 1967).

Protocitta ajax Brodkorb 1972. Ajax Jay. Extinct. A tarsometatarsus representing this species collected from Late Pliocene (Blancan) deposits at Palo Duro Falls, Randall County, Texas (Miller and Bowman 1956b). The specimen was first thought to be from a Black-billed Magpie (*Pica hudsonia*), but an evaluation by Brodkorb (1972) led him to believe that it represented a new species of *Protocitta*. This jay, named for the Greek hero Ajax, has also been recorded from Kansas.

Brodkorb (1957, 1972) considered the White-throated Magpie-Jay (*Calocitta formosa*) and the Brown Jay (*Cyanocorax morio*) to be the closest living relatives of *Protocitta*. Steadman and Martin (1984) have suggested that Dixie and Ajax Jays may be extinct species of *Calocitta* or *Cyanocorax* that ranged further north during the Pliocene and Pleistocene.

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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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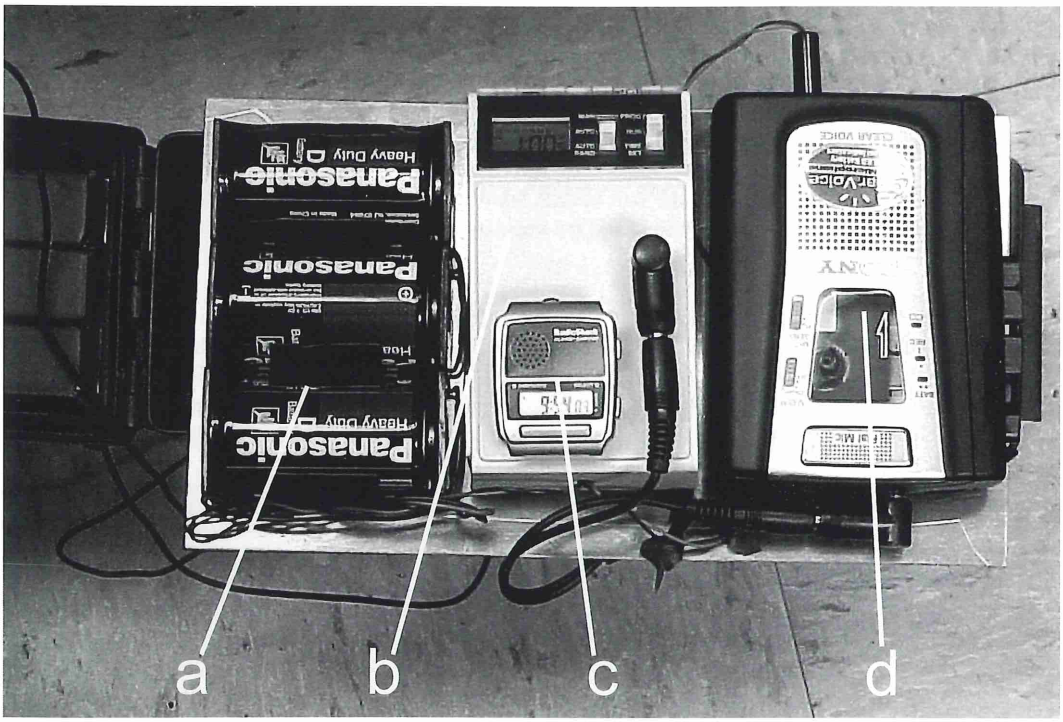

Figure 1. The internal components of the dataloggers. a batteries, b timer, c talking watch, and d tape recorder.

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 weath-

erproof 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).

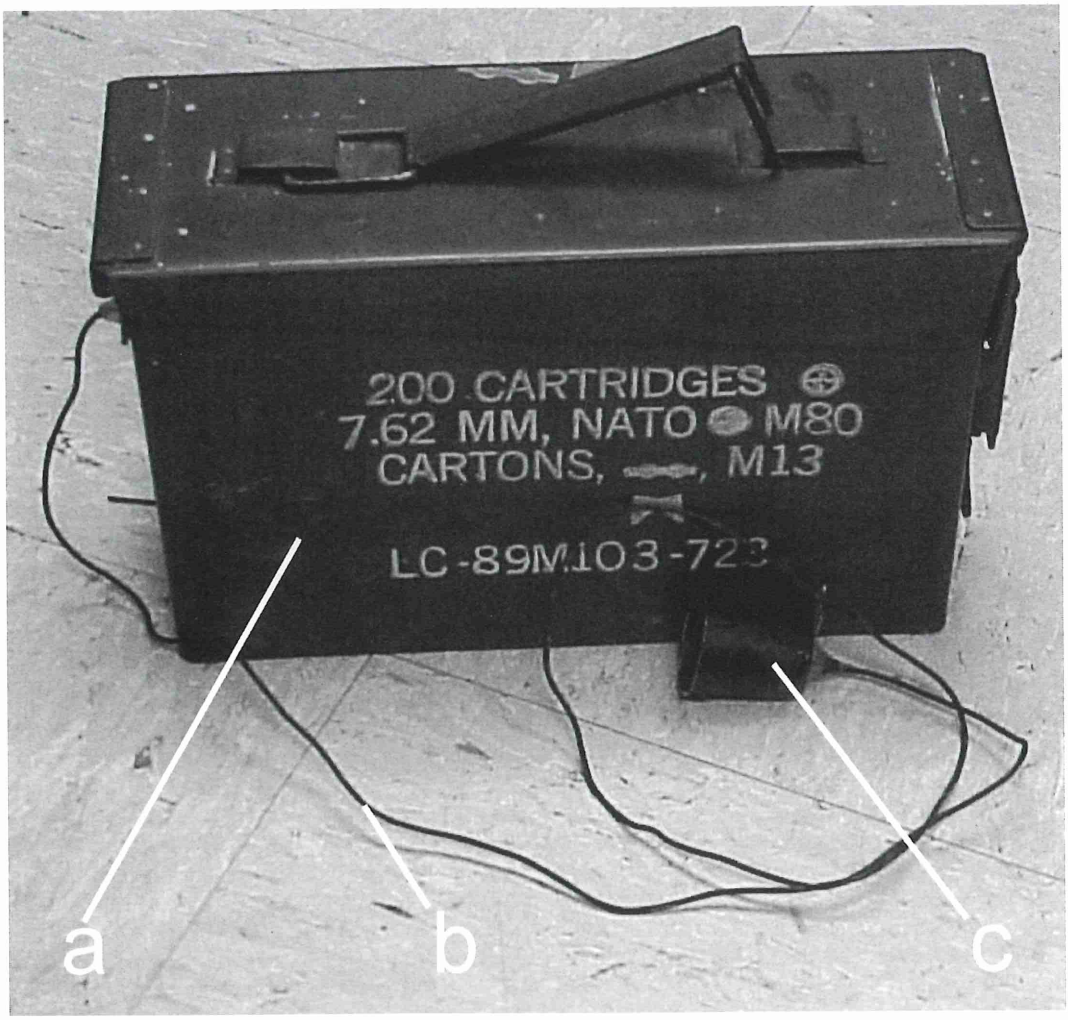

Figure 2. The external components of the dataloggers. a ammunition case housing, b microphone wire, c microphone.

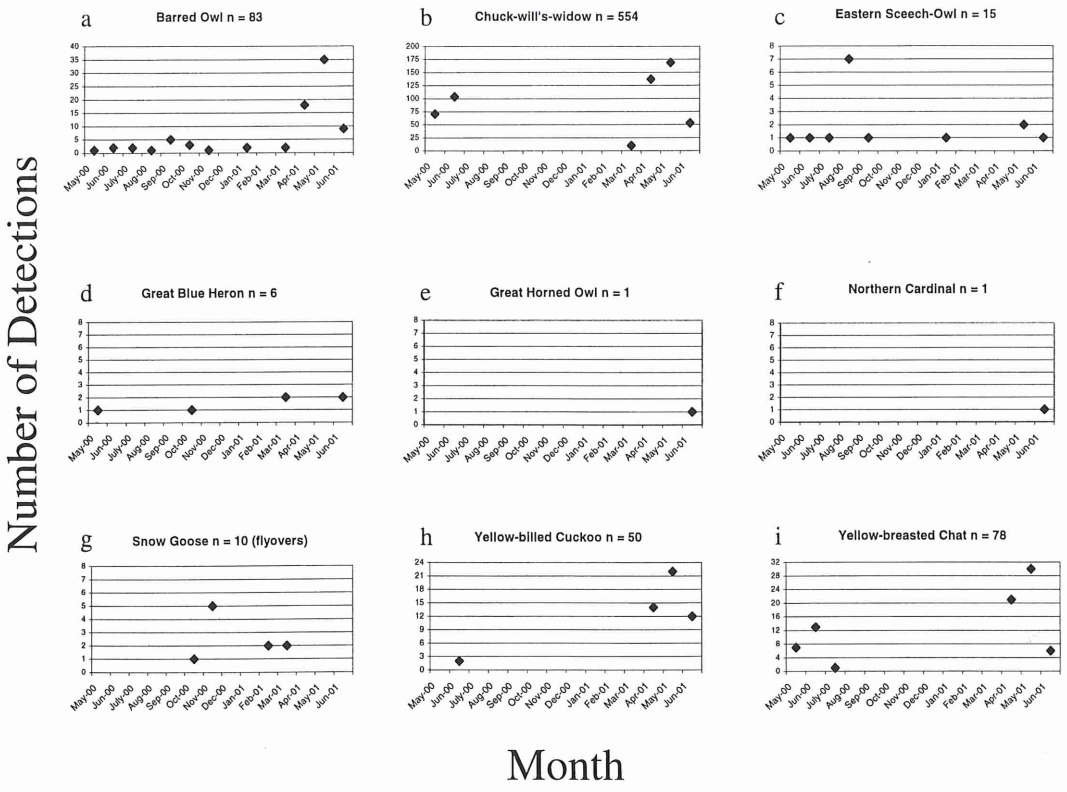

Figure 3. Number of detections for each species by month.

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.

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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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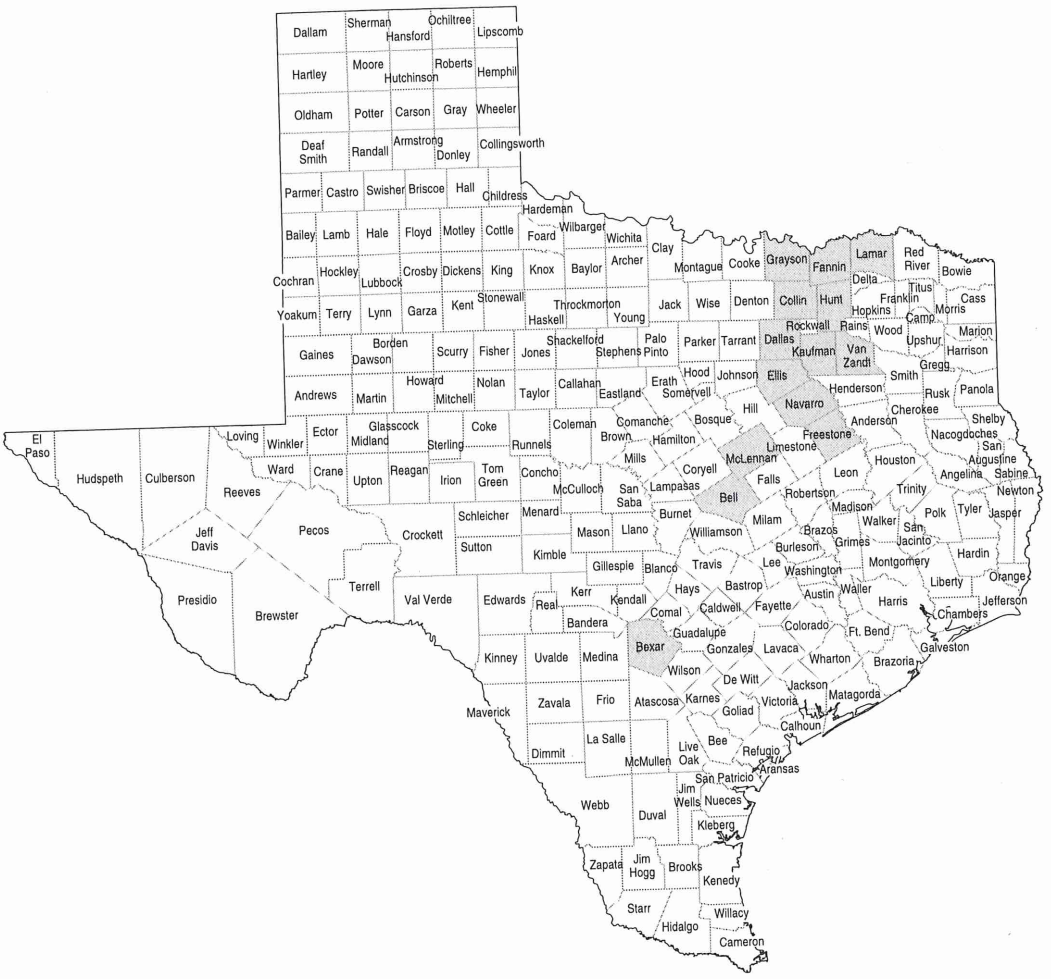

Figure 1. Texas counties reporting crop damage by migrating Dickcissels from 1849 through 1891.

farmer who lost his entire crop in spite of using guns, noise-makers, and bludgeons to drive the birds away. Damage to the wheat was caused by a bird alighting upon a stalk, inserting its bill into an immature grain, extracting its milk, and so on, until the entire head was destroyed (1858c).

Dickcissels soon became regular visitors to the wheat growing regions of Texas. In May 1857 they made their appearance near Dallas and, finding no wheat, began feeding on the cutworms that had already destroyed much of the crop (Anon 1857). Wheat birds appeared again in Dallas and surrounding areas during 1858 but not in sufficient numbers to do serious damage (Anon. 1858b). Freestone County was invaded by "millions" of Dickcissels in 1859 (Anon. 1859) and they again returned during 1860 to destroy all of the early wheat in the county in spite of the farmers "shooting them, putting up scarecrows, [and] smoking them with rolls of sulphur (Anon. 1860). Damage by wheat birds was reported during 1869 in Lamar and Collin counties (Anon. 1869).

Dickcissels were particularly troublesome during the 1870s. In 1873 they were reported from Dallas, Hunt and Van Zandt counties (Anon. 1873). In May 1874 "great damage" was done to the wheat in Kaufman County (Anon. 1874). In 1875 they again returned to Kaufman causing "some damage and much alarm" (Julius 1875). Dickcissels were so numerous in Hunt County during 1877 that boys riding ponies were dispatched to scare them from the fields (Anon. 1877). During 1878 they were reported doing their "level best" to eat up the wheat crop in Fannin County (Anon. 1878). Damage from unusually large numbers of

Dickcissels occurred during May 1879 in Collin, Dallas, Grayson, Hunt, Kaufman, McLennan, Navarro and Van Zandt counties (Anon. 1879). The wheat birds in Navarro during 1879 were described as being "worse than ever before" and "tin cans, pans, buckets, bells, and everything that would make a noise" was used in an effort to drive them away.

Crop damage by Dickcissels decreased during the 1880s. In 1880 they appeared in Collin and Ellis counties (Anon. 1880). Injury to the developing wheat was reported during 1881 in McLennan and Kaufman counties (Anon. 1881). In May 1882 they damaged the oats in Bell County (Anon. 1882). The last known incidence of damage occurred in 1891 when a farmer in Bexar County reported that Dickcissels had destroyed about 25% of his oat crop (Attwater 1892).

Damage to wheat and oats by migrating Dickcissels was reported in fourteen counties from 1849 through 1891 (Fig. 1). By 1885 the large flocks that had terrorized farmers in previous years were a thing of the past (Peters 1885). Their disappearance was believed by H. F. Peters (1885) to have been caused by the increased cultivation of wheat and small grain in the mid-western states that are the primary breeding grounds for the Dickcissel. Peters further concluded that the majority of the migrants passed over Texas simply because they found the northern regions of the country "more to their liking."

Historically, the distribution of the Dickcissel throughout its breeding range has been erratic and its numbers often fluctuate greatly from year to year. The cause of these fluctuations, which often extend over very large areas, is unknown (Gross 1968). The visitation of large numbers of Dickcissels to the fields of Texas for nearly 30 years, followed by their gradual decrease, provides yet one more example of the enigmatic nature of this species.

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For over 40 years during the 19th century enormous flocks of Dickcissels caused great damage to wheat crops in Texas. Photo A. Morris@VIREO

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