

NOTES ON POPULATION DENSITY AND NESTING OF BELL'S VIREO
ALONG THE CANADIAN RIVER IN CENTRAL OKLAHOMA

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Introduction - During the spring and summer of 1995, while monitoring Least Terns (*Sterna antillarum*) along the Canadian River in Cleveland and McClain counties in central Oklahoma, we conducted an ancillary study of Bell's Vireos (*Vireo bellii*). Although the Bell's Vireo was at one time considered "the commonest of its family in the vicinity of Norman, Oklahoma, and a bird that adapts itself well to civilization and gardens" (Nice, 1929), it is now classified by the state of Oklahoma as a Category II Species of Special Concern (Oklahoma Department of Wildlife Conservation, Non-game Technical Committee). This indicates that the species has been identified by technical experts as possibly threatened or vulnerable to extirpation, but little, if any, evidence exists to document the population level, range, or factors pertinent to its status. In addition, the Oklahoma Natural Heritage Inventory has ranked the Bell's Vireo an S3 species (on a scale of S1 to S5, with S1 being the most critical).

Breeding Bird Survey records (Robbins et al., 1986; unpubl. Breeding Bird Survey data) give credence to these rankings. From 1966 to 1979, the records show a sharp decline (about 40%) in Bell's Vireo populations in the central United States, and significant declines from 1966 to 1989 in all or portions of Arkansas, Oklahoma, Missouri, Texas and South Dakota. Populations in the Lower Colorado River Valley in Arizona and Texas are nearly extirpated (Rosenberg et al., 1991), and the Least Bell's Vireo (*Vireo bellii pusillus*) is listed as endangered in California by the United States Fish and Wildlife Service and the state of California (Title 50 CFR, 1994). High rates of brood parasitism by the Brown-headed Cowbird (*Molothrus ater*) and habitat loss and change are given as reasons for these declines (Brown, 1993).

Purpose and Justification - The Bell's Vireo breeds in dense, low, shrubby vegetation generally characteristic of early successional stages of growth (Photo 1). Agri-



Photo 1. Typical Bell's Vireo habitat along the Canadian River in central Oklahoma. Photo by Nathan Kuhnert, August 1995.



Photo 2. Four Bell's Vireo nestlings, approximately 12 days old, at Lake Hefner in Oklahoma County, OK. Photo by Mitchell Oliphant, 23 June 1989.

culture, grazing, urbanization and flood control projects have all reduced the available habitat for this and associated species (Brown, 1993). In one Oklahoma study (Overmire, 1963), overgrazing alone was found to suppress shrub growth and reduce available habitat and density of Bell's Vireos by 50%.

Relatively undisturbed riverbottom lands may be the last stronghold for this species, especially in areas where intensive land use has greatly reduced or eliminated other suitable habitat. Due to periodic flooding, much of the vegetation along the Canadian River is continually in an early successional stage and therefore provides the thick brushy growth that the vireos seem to prefer. Sandbars and banks covered with two to three-year old willows and cottonwoods about two to three meters in height are especially favored.

The purpose of this preliminary investigation was to collect baseline information on the population density and nesting of the Bell's Vireo along a stretch of the Canadian River in central Oklahoma. This data should help document the vireo's population level and other factors regarding its status that can be used in formulating management recommendations for the vireo and associated species.

Methods - From May through August 1995, large portions of riparian habitat along a 33-km (20-mile) section of the Canadian River running from the Interstate-44 bridge north of Newcastle, Oklahoma, southeastward to just north of Purcell, Oklahoma, were surveyed for Bell's Vireos. Because these surveys were corollary to our Least Tern research, we employed the strategy of obtaining as much data as possible on population density and nesting from brief but regular observations as we passed through vireo habitat on our frequent trips to and from the riverbed.

To determine the number and population density of vireos present in an area, we used the territory spot-mapping techniques suggested by Byre (1989). Ten routes, varying in length from 0.5 km to 2.5 km, for a total distance of 12.75 km, were established through the study area. The routes, which were also used to obtain access to the tern colonies, were distributed throughout the entire 20-mile stretch of the river. In addition, listening stations were established at the five tern study areas. A minimum of two surveys was conducted for each of the 10 routes, although many of the routes were surveyed as many as a dozen times throughout the summer. At points along each route, we stopped, listened, and noted all vireos detected on a sketched map of the area. Areas containing high population densities were also recorded on 1:24,000-scale, 7.5-minute topographic maps. Because Bell's Vireos are known for their persistent singing, throughout both the day and the season, because they are exceedingly vociferous and easily detectable (Goldwasser et al., 1980), and because their primary song is audible up to 120 m or more (Barlow, 1962), we are confident that we detected virtually all vireos present in the study area.

An attempt was made to locate at least one vireo nest along each route where frequent follow-up visits would be possible. Nests were located by first listening for a singing male or an adult giving distress calls. We then slowly and carefully approached the vegetation from which the vocalizations were detected. To help minimize the risk of increased nest predation due to monitoring efforts, we followed the nest searching strategy suggested by Ralph et al. (1993). Nests were approached from different paths on subsequent visits, and we used paths that were quick, quiet, caused a minimum of disturbance to vegetation, and did not leave a

“dead end” trail to the nest. After a nest was located, a pen or stick was used to part the vegetation, allowing us a view of the nest without leaving human scent on the nest or nest branch. If the nest was active, every effort was made to monitor its progress and (under the proper permits) remove cowbird eggs.

To help locate the nest on follow-up visits, a nearby tree was marked with a small piece of yellow tape, or small survey flags were placed nearby. Physical habitat features of the nest such as nest elevation above the ground, species of tree or shrub containing the nest, and approximate distance from the nest to the center of the tree were recorded, as were general habitat features characterizing the immediate area. At the end of the breeding season, photographs were taken of several of the more densely populated nesting areas.

Results - Eighty-eight Bell’s Vireo territories were found along the 12.75 km of survey routes. Vireo densities ranged from 3.6 to 14.4 pairs/km, resulting in an average density of 6.9 pairs/km (Table 1).

Eighty-nine per cent of the 21 nests found were built in small (2-3 m high) willows (*Salix* sp.), and 11% were built in eastern cottonwood (*Populus deltoides*). The average height of the nests above the ground, 1.3 m, was skewed slightly by one nest that was located 3 m up in a tall cottonwood, much higher than the 1.1 m height averaged by the other 20 nests (Table 2).

Table 1. Territories and population densities of Bell’s Vireo on ten survey routes along the Canadian River in central Oklahoma during 1995.

Approximate geographic location of survey route ¹	Length of survey route (km)	Total number of territories located	Population density (pairs/km)
SW 1/4, Sect. 26, T 10N, R 4W, Oklahoma City SE Quad.	1.25	18	14.4
SW 1/4, Sect. 19, T 9N, R 3W, Newcastle Quad.	1.25	12	9.6
NW 1/4, Sect. 32, T 9N, R 3W, Newcastle Quad.	0.75	5	6.7
SE 1/4, Sect. 32, T 9N, R 3W, Newcastle Quad.	0.75	4	5.3
SW 1/4, Sect. 33 T 9N, R 3W, Newcastle Quad.	2.5	9	3.6
NE 1/4, Sect. 3, T 8N, R 3W, Norman Quad.	0.75	4	5.3
NE 1/4, Sect. 18, T 8N, R 2W, Norman Quad.	1.5	12	8.0
SE 1/4, Sect. 18 T 8N, R 2W, Norman Quad.	0.5	2	4.0
SW 1/4, Sect. 20 T 8N, R 2W, Norman Quad.	2.0	13	6.5
NE 1/4, Sect. 14, T 7N, R 2W, Washington Quad.	1.5	9	6.0
Totals	12.75	88	6.9 (avg.)

¹Survey routes were plotted from upstream (northwest) to downstream (southeast).

Nineteen young fledged from the 16 nests that were monitored to final outcome, resulting in a fledging rate of 1.2 fledglings/nest, and 3.8 fledglings/successful nest (Table 2). Three additional Bell's Vireo fledglings that could not be positively associated with a specific nest were observed on one route.

Eight newly constructed and freshly lined nests that were empty and deserted were found, as well as two deserted nests containing cowbird eggs. Cowbird eggs were in two other active nests as well, one of which failed (Table 2).

Discussion - The population density of Bell's Vireos in our research area was high compared to similar studies conducted elsewhere. Small, extremely productive riparian study areas in Arizona, probably quite like the habitat along the Canadian River in central Oklahoma, yielded extrapolated densities as high as 200.2 pairs/40 ha (Brown, 1987). If a similar calculation were done for our study area, Bell's Vireo densities would range from 144 - 576 pairs/40 ha. Surveys for Bell's Vireos in somewhat similar, but less productive riparian habitat in Texas resulted in population estimates of 3-26 pairs/40 ha (Engel-Wilson and Ohmart, 1978).

Table 2. Data on Bell's Vireo nests found along the Canadian River in central Oklahoma in 1995

Nest Number	Date nest first observed	Nest tree (genus)	Nest height above ground (m)	Status of nests	
				First observation	Final outcome
1	18 June	<i>Salix</i>	1.1	3 vireo eggs, 1 vireo chick	4 vireo fledglings
2	18 June	<i>Salix</i>	1.1	4 vireo eggs	4 vireo fledglings
3	18 June	<i>Salix</i>	1.1	Abandoned, fresh lining	Abandoned
4	18 June	<i>Salix</i>	1.1	Active, no eggs	Unknown
5	18 June	<i>Salix</i>	1.1	Abandoned, fresh lining	Abandoned
6	18 June	<i>Salix</i>	1.1	Active, no eggs	Unknown
7	18 June	<i>Populus</i>	1.5	Abandoned, partly torn	Abandoned
8	18 June	<i>Salix</i>	0.9	Abandoned, fresh lining	Abandoned
9	16 June	<i>Salix</i>	0.9	Abandoned, fresh lining	Abandoned
10	16 June	<i>Salix</i>	1.1	Abandoned, fresh lining	Abandoned
11	16 June	<i>Salix</i>	1.1	Abandoned, fresh lining	Abandoned
12	10 July	<i>Salix</i>	1.2	1 vireo egg	Abandoned, 2 vireo eggs, 1 cowbird egg
13	12 July	<i>Salix</i>	1.1	Active, no eggs	Unknown
14	12 July	<i>Populus</i>	3.0	3 vireo eggs	3 vireo fledglings
15	10 June	<i>Salix</i>	1.2	3 vireo eggs, 1 cowbird egg*	4 vireo fledglings
16	15 June	<i>Salix</i>	1.2	Broken cowbird egg*	Abandoned
17	15 June	<i>Salix</i>	1.1	Under construction	Unknown
18	15 June	<i>Populus</i>	0.9	4 vireo eggs	4 vireo fledglings
19	13 July	<i>Salix</i>	0.8	Abandoned, fresh lining	Abandoned
20	20 June	<i>Salix</i>	0.8	1 cowbird egg*	Abandoned
21	20 June	<i>Salix</i>	1.1	Active, fresh lining	Unknown

*Cowbird egg removed (under the proper permit) on the first nest visit.

We do not know how long the Canadian riverbottom has supported Bell's Vireo populations of this magnitude, but a 1992 survey done by Byre (unpubl. data) along 5 km within the present study area yielded 14.4 Bell's Vireo territories per km, a density comparable to our 1995 results.

The range of territory sizes found in our study (<0.1 ha to >1 ha) was similar to the range of sizes reported by other researchers, e.g. Barlow (1962), Gray and Greaves (1984) and Collins et al. (1989). During a study of this species in the Lower Colorado River Valley, Grinnell (1914) found that in prime habitat, singing males occupied successive segments of about 200 yards (184 m) in a belt of willows between the Colorado River and the desert. This situation was similar to ours, in that one or more singing males occupied almost every willow thicket on the sandbars and banks between the river and the taller, more mature vegetation farther from the water. In two instances, we found newly constructed nests less than 1.5 m apart. In each case however, only one nest was active, leading us to conclude that both probably had been built by the same pair.

Brown-headed Cowbird parasitism of Bell's Vireo nests is well documented in Oklahoma. For example, Nice (1929) reported a 78% parasitism rate (7 of 9 nests found in Cleveland County), Parmelee (*in* Graber 1961) a 55% rate (12 of 22 nests found in Cleveland County), and Overmire (1962) a 30% rate (18 of 61 nests found in Payne County). In our study, 50% (4 of 8) of nests with eggs were parasitized. In addition, we suspect that most of the eight newly constructed but deserted Bell's Vireo nests that we found may have been abandoned as an anti-cowbird strategy.

If a cowbird egg is laid in a Bell's Vireo's nest early in the vireo's nesting cycle, especially in the early part of the season before a vireo egg is laid, or after only one vireo egg has been laid, the vireo is quite likely to desert the nest (Barlow, 1962). One nest observed in our study was deserted within 48 hours after the addition of a cowbird egg, even though the nest already contained two (possibly three) vireo eggs. Indeed, nest abandonment may be this vireo's most common anti-cowbird strategy, and as a result, the percent of cowbird eggs hatched (by Bell's Vireos) in relation to the number laid may be relatively low (Bent, 1950; Mayfield, 1965).

Later season cowbird eggs (e.g., those laid from mid-June to mid-July), even those deposited prior to vireo eggs, seem to be more readily accepted by the vireos (Barlow, 1962). In fact, Sutton (1964, p. 558) believed the Bell's Vireo to be among the least successful of the cowbird's hosts, subject to heavy parasitism and frequently fledging cowbird young, but rarely its own young also. Brown (1993) reported that Bell's Vireos usually do not lay replacement eggs to compensate for eggs removed by cowbirds unless a new nest is layered over the top of the old one. We did observe, however, one instance in which, after our removal of a cowbird egg from among three Bell's Vireo eggs, an additional vireo egg was laid. All four vireo eggs subsequently hatched (as in Photo 2, but see caption).

Although we were unable to establish the number of broods produced by a pair of vireos during the season, several researchers (Barlow, 1962; Franzreb, 1989; Rosenberg et al., 1991; Brown 1993) are of the opinion that, at least in parts of its range, the Bell's Vireo is normally double-brooded. However, it rarely rears two broods, due to nest failures. Pitelka and Koestner (1942) documented four nesting attempts by a single pair before they were successful, each failure being due to cowbird parasitism. Five of the six nests in our study that contained vireo eggs

when discovered were successful, resulting in the high fledging rate of 3.8 fledglings/successful nest. Many of these nests, however, may represent second or even third nesting attempts by a single pair.

Because cowbird egg-laying is largely over by mid-July in Oklahoma, Sutton (1967, op. cit, p. 477) believed that nestings in July and August were those most likely to be successful. Persistence in re-nesting and late season success may explain, at least in part, why we heard Bell's Vireos actively singing and defending territories as late as 15 September.

Other nesting species in our study area included Yellow Warbler (*Dendroica petechia*), Common Yellowthroat (*Geothlypis trichas*), Blue Grosbeak (*Guiraca caerulea*), Lark Sparrow (*Chondestes grammacus*), and Dickcissel (*Spiza americana*). None of these species, however, exhibited population densities approaching that of the Bell's Vireo, and no direct interspecific competition was observed.

We are of the opinion that, if the Canadian riverbottom continues to undergo scouring floods every two to three years, early successional stage habitat sufficient to support present Bell's Vireo populations (and those of associated species) will be maintained. But further alterations or modifications to the natural flow rate of the river, especially by construction of additional upstream dams, may have an increasingly adverse impact. Whether or not the Bell's Vireo can withstand present or increasing pressure from Brown-headed Cowbird parasitism, however, remains to be seen.

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GENERAL NOTE

Brown-headed Cowbirds fledged from a Louisiana Waterthrush nest.—Although Friedmann (1929; 1963; Friedmann et al, 1977) considered Louisiana Waterthrushes (*Seiurus motacilla*) to be frequent hosts of Brown-headed Cowbirds (*Molothrus ater*), no record of parasitism has been reported in Oklahoma. On 6 July 1995, I located a Louisiana Waterthrush nest under a root tangle along a small drainage in Clear Creek Canyon near Pawhuska Lake, 3 miles west and 1 1/2 south of Pawhuska, in Osage County, Oklahoma. Upon examination, I noticed that at least one of the three young contained in the nest was a Brown-headed Cowbird. As I attempted to move the cowbird young so that I could more closely examine the other two nestlings, all three jumped from the nest. They were all fully feathered cowbird nestlings, capable of flying two to three meters. I placed them back into the nest. The following day, I examined the now empty nest, and no adult waterthrushes or fledgling cowbirds were

seen. On three or four occasions over the next couple of weeks, an adult waterthrush was in the area of the nest, and chipped as if annoyed at my presence.

Friedmann (1929; 1963) suggested that Louisiana Waterthrushes are multiply parasitized more frequently than most species, noting that ten (18.2%) of 55 nests on which he had data contained three or four cowbird eggs each. Eaton (1958) reported that three (18.8%) of 16 Louisiana Waterthrush nests he monitored in New York from 1947 through 1949 held three or four cowbird eggs each, although these nests were not included in Friedmann's aforementioned computations. A waterthrush nest in Iowa contained six cowbird eggs together with two waterthrush eggs (Lowther, 1985). Bent (1953) stated that "Three or four eggs of the cowbird are likely to cause the waterthrush to desert the nest." Eaton (1958), however, reported that of two waterthrush nests containing three cowbird eggs each, one fledged two cowbirds and no host young, and another nest containing four cowbird eggs fledged three cowbirds and one host young. Apparently, Bent's statement does not always hold true, as at least two (67%) of Eaton's multiply parasitized nests were not abandoned; the female waterthrush was killed at the third nest.

Also of interest is the late date of this nest. The latest dates given by Sutton (1967) were 28 June for a fledgling waterthrush seen with an adult, and 25 June for young still in the nest. The above observation took place more than a week later than these dates. Perhaps many earlier nests were destroyed by floods due to higher than average rainfall in April and May of 1995.

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