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NESTING OF THE EASTERN BLUEBIRD IN PONTOTOC COUNTY, OKLAHOMA

BY WILLIAM A. CARTER

The Eastern Bluebird (*Sialia sialis*) is one of North America's best-loved birds. Bluebird trails, bluebird clubs, bluebird art prints, and extensive literature about bluebirds attest to its popularity (see Peakall, 1970, The Living Bird, 9: 239-255; Pinkowski, 1978, Wilson Bull., 90: 84-99; Krieg, 1971, New York State Mus. Bull. 415, 105 pp.; and Zeleny, 1976, The Bluebird, Indiana Univ. Press, 170 pp.). Until a few years ago the species was considered common throughout the eastern part of the continent, but recent reports have indicated that it has become uncommon to rare in many areas.

From 1971 to 1974, when the Eastern Bluebird was common on the Carter family's farm at Oakman, a small community 7 miles northeast of the city of Ada, in Pontotoc County, south-central Oklahoma, I conducted an intensive study of its nesting. The farm is typical of upland areas within the cross-timbers of central Oklahoma. Intermixed with second-growth blackjack and post oak woodland are open grassy stretches used as pasture. On fence posts and trees along the edges of this grassland I placed thirty nest-boxes, each

EASTERN BLUEBIRD

Adult male photographed by Wesley S. Isaacs in the southeastern part of Oklahoma City on 13 April 1980. The picture won Honorable Mention at the Oklahoma Ornithological Society's annual photo contest in 1980.

about 5½ feet from the ground and each with roof so hinged as to allow quick access while checking nesting progress.

My collaborators (J. Tracy Goodwin in 1971, John R. Schenck in 1972, Charles L. Barnes in 1973 and 1974) and I checked each nest-box weekly from mid-March until nesting activities ceased in early August. During the peak of nesting, we checked the boxes more frequently.

Results and Discussion

The bluebirds made 81 nesting attempts (51 of which fledged at least one young bird) during the four-year period—19 in 1971, 26 in 1972, 18 in 1973, 18 in 1974. Of the nestings, 78 were in boxes, one was 9 feet up in a cavity in a dead elm snag (1971), one was 3 feet up in a cavity in a wooden fencepost (1972), and one was in a compartment of a house for Purple Martins (*Progne subis*) on a pole well away from trees (1974).

1971: In 18 of the 19 nestings observed, a full clutch of eggs was laid (total number of eggs laid: 84). In 17 of the 18 nestings some eggs hatched (total number of hatchlings: 65). In 14 of the 18 nestings some hatchlings fledged (total number of fledglings: 54). Six of the 1971 nestings were parasitized by the Brown-headed Cowbird (*Molothrus ater*), but at each of the parasitized nests some bluebirds fledged. Egg-laying took place between 31 March and 9 May, between 20 May and 18 June, between 29 June and 18 July, and between 29 July and 7 August (no eggs were laid between 10 and 19 May, between 19 and 28 June, and between 19 and 28 July); in Peakall's "Region 15" (Arkansas, 6 nest records; Kansas 26; Missouri 89; Oklahoma 105; Texas 10) some eggs were laid during the three periods just mentioned (see Table I). Eighteen of 19 Pontotoc County nests held full clutches of eggs, but at only 17 nests did some eggs hatch; six nests were cowbird-parasitized (see Table II); at 14 nests a total of 54 young fledged (see Tables II and III).

Table I

Percentage of Eastern Bluebird clutches completed during a four-year period in Oklahoma compared with Peakall's (1970) data for a longer period in Kansas, Missouri, Arkansas, Oklahoma, and Texas. N = Number of Nestings.

Egg-laying Interval	1971	1972	1973	1974	Pontotoc County	Peakall's Region 15
	N=19	N=25	N=16	N=17	N=77	N=236
11-20 March						0.88
21-30 March				5.88	1.30	3.54
31 March to 9 April	5.26	24.0	18.75	17.65	16.88	10.18
10-19 April	10.50	4.0	18.75		7.79	14.16
20-29 April	10.50	8.0	12.50	5.88	9.09	9.73
30 April to 9 May	5.26	8.0		5.88	5.19	7.52
10-19 May		8.0	6.25	5.88	5.19	7.52
20-29 May	10.50	16.0		11.76	10.40	9.29
30 May to 8 June	10.50	4.0	12.50	11.76	9.09	10.18
9-18 June	10.50	8.0	6.25	23.53	11.69	9.29
19-28 June		4.0	18.75		5.19	6.19
29 June to 8 July	15.78	8.0	6.25	11.76	10.40	7.08
9-18 July	10.50	8.0			5.19	2.21
19-28 July						1.77
29 July to 7 August	10.50				2.60	.44

1972: In 25 of the 26 nestings observed, eggs were laid. Two periods (31 March to 9 April and 20-29 May) were notable for the large number of eggs laid, and no period between 31 March and 18 July was without egg-laying (see Table I). At 22 of 25 nests clutches were completed; a total of 103 eggs were laid; at 21 nests 92 eggs hatched; two of the nests were cowbird-parasitized (see Table II); at 18 of the nests a total of 80 young fledged (see Tables II and III).

Table II

Eastern Bluebird Nestings in Pontotoc County, Oklahoma 1971-1974

	1971	1972	1973	1974	Total
Nests completed	19	26	18	18	81
Nests with one or more eggs	19	25	16	17	77
Nests with complete clutches	18	22	15	16	71
Eggs in completed clutches	84	103	66	75	328
Nests with hatching	17	21	12	11	61
Hatchlings	65	92	49	39	245
Nests with fledging	14	18	10	9	51
Fledglings	54	80	42	36	212
Nests with cowbird eggs	6	2	1	3	12

1973: Eggs were laid in 16 of 18 nests. Egg-laying took place from 31 March to 29 April, from 10 to 19 May, and from 30 May to 8 July; no eggs were laid between 30 April and 9 May or between 20 and 29 May; in Peakall's "Region 15" eggs were laid during each of these two periods (see Table I). In Pontotoc County, 15 nests with eggs held complete clutches (total of 66 eggs) and 49 eggs hatched; one nest was cowbird-parasitized (see Table II); ten of the nests fledged a total of 42 young (see Tables II and III).

Table III

Nesting Success of Eastern Bluebirds in Pontotoc County, Oklahoma

Year	Total nests completed	Total nests that fledged young	Total fledged young	Percentage of nests completed that fledged young	Total fledglings per nest
1971	19	14	54	73.68	2.84
1972	26	18	80	69.23	3.08
1973	18	10	42	55.55	2.33
1974	18	9	36	50.00	2.00
Total	81	51	212		

1974: Of the 18 nests observed, 17 received eggs. These were laid between 21 March and 9 April, between 20 April and 18 June, and between 29 June and 8 July (no eggs were laid between 10 and 19 April or between 19 and 28 June); Peakall recorded some egg-laying during all of these periods (see Table I). In Pontotoc County, 16 of 17 nests that held eggs had complete clutches (total of 75 eggs); at only 11 nests did some eggs hatch; three nests were cowbird-parasitized (see Table II); at the 11 nests just mentioned a total of 36 young fledged (see Tables II and III).

In Pontotoc County — during the four-year period discussed here—the breeding season extended from late March (clutch of four eggs completed 25 March 1974) until early August (clutch of four eggs completed 4 August 1971). Peakall "determined the breeding season by calculating the date on which the female completed the clutch and then totaling the number of such records for

each 10-day period." In his "Region 15" the nesting season extended from mid-March to the first week of August. Table I gives the percentage of clutches completed within each 10-day period for my study and for Peakall's "Region 15." Although nesting occurred in Pontotoc County in each 10-day period from the last of March until early August, two peaks accounted for 65% of the nestings — from 31 March to 29 April for first nesting and from 20 May to 18 June for second nesting. These data compare favorably with Peakall's.

Nesting Success

Nesting success is highly relative. No matter how large the breeding population, if one egg is laid or if one brood fledges, there has been *some* nesting success. Achieving anything like 100% success is, of course, virtually impossible, adverse factors such as predators, storms, very hot weather, etc. being what they are. Table III makes clear how "successful" the Pontotoc County populations were during the four-year period of this study.

Table III is realistic. If, of a total of 81 nestings during a four-year period, only 51 of them produced fledglings, the species was only 62.96% successful during that period. Furthermore, if the average brood produced per nesting was only 2.62 fledglings, then the species was little more than reproducing itself (i.e., replacing the breeding pair with the same number of young).

To be borne in mind is the possibility that our repeated visits to the nests attracted predators. The visits might, indeed, have led directly to some desertion, though I did not observe behavior that clearly showed how badly annoyed the bluebirds were by our brief investigations.

In determining clutch-size, I have used only data from completed clutches with the maximum number of bluebird eggs known. At two of the nestings a single egg disappeared during incubation. I suspect that an egg is occasionally lifted from the nest by the feathers surrounding the brood-patch as the incubating bird leaves. I have found cool eggs on the nest's rim while eggs in the nest cup were warm. When I moved the cool eggs back into the cup, a prolonged incubation of three days — rather than the usual one or two—resulted. Using only full-clutch data, I found the average clutch-size to be 4.67 in 1971 (84 eggs in 18 clutches); 4.68 in 1972 (103 eggs in 22 clutches); 4.40 in 1973 (66 eggs in 15 clutches); and 4.69 in 1974 (75 eggs in 16 clutches). The over-all clutch-size was 4.62.

Another measure of success is the percentage of eggs from completed clutches that eventually produced fledglings. These percentages were (figures rounded off to nearest whole number): 64% in 1971 (84 eggs produced 54 fledglings); 78% in 1972 (103 eggs fledged 80 young); 64% in 1973 (66 eggs produced 42 fledglings); and 48% in 1974 (36 fledglings were produced from 75 eggs). The over-all average was 65%.

Nesting losses are difficult to determine because actual observations of losses are rare: see Pinkowski (1975, Inland Bird Banding News, 47: 179-186) for a discussion of possible causes of Eastern Bluebird nest failure.

In my study, House Sparrows (*Passer domesticus*) drove the bluebirds off while attempting to use five different nest boxes. In one of these the bluebirds

had already laid three eggs. We found a 17-inch Black Rat Snake (*Elaphe obsoleta*) in a nest that had, when last examined by us, held three bluebird eggs. From ten nests all bluebird eggs were removed, and from five others all hatchlings, presumably by some predator. In all 15 cases the nests proper were left intact, however, a circumstance suggesting snake predation. Two nest boxes were found askew, their nesting material in disarray, eggs missing. I suspected that Raccoons (*Procyon lotor*) were responsible.

Two nests were deserted after prolonged incubation (18 and 21 days, respectively) in late July. In four other July nests we found dead nestlings. These losses I attributed to high temperatures.

One nest containing three eggs was deserted for no apparent reason. Possibly one or both of the adults met with disaster. One nest that held three bluebird eggs was deserted after two cowbird eggs were added.

Around one nest that was completed by 31 March 1972, I never saw adult birds and no eggs were laid. When we removed this nest in order to clean the nest box on 18 May, we found a paper-wasp's nest under the lid and—under the bluebird nest—the mummified carcass of the male bird. The female apparently had completed her nest after the death of her mate. Three other completed nests never received eggs.

Though Friedmann (1929, The Cowbirds, Charles C. Thomas, Springfield & Baltimore, p. 260) called *Sialia sialis* "a very uncommon victim" of the cowbird, our Pontotoc County population was several times parasitized. My nest boxes had a perch just below the entrance. I was to learn that boxes designed without such a perch receive little parasitism by cowbirds.

Cowbird eggs appeared in bluebird nests from 21 April until 28 June. Five nests were parasitized in April, three in May, and four in June. Cowbird parasitism had little effect on the nesting success of bluebirds during this study.

Other cavity-nesting birds that successfully used our nest boxes included the Carolina Wren (*Thryothorus ludovicianus*), Carolina Chickadee (*Parus carolinensis*), and Tufted Titmouse (*P. bicolor*). House Sparrows attempted to nest in the boxes, but I destroyed their nests each time I found them. Starlings (*Sturnus vulgaris*) investigated boxes, but the openings were apparently too small for them and I found no evidence of their nesting.

A Flying Squirrel (*Glaucomys volans*) occupied one box for several weeks. Fox Squirrels (*Sciurus niger*) damaged or destroyed a few boxes by enlarging the entrance hole.

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WINTER FORAGING HABITS OF THE ROADRUNNER

BY KATHLEEN G. BEAL

Little is known of the winter foraging behavior of the Roadrunner (*Geococcyx californianus*) in non-desert habitats (but see Geluso, 1970, Bull. Oklahoma Orn. Soc., 3: 32). I observed nine adult (or adult and first-year)

Roadrunners at Buncombe Creek Recreation Area near Willis, Marshall County, south-central Oklahoma and at Hagerman National Wildlife Refuge near Sherman, northeastern Texas, during December in 1976 and 1977, thus obtaining information on foraging habits and on relative success in different habitats.

The Roadrunners that I observed restricted their foraging to areas of short and tall grasses. Never did I see them foraging in bushy or wooded areas. Both study areas were characterized by clearings of mowed grass generally less than 10 centimeters (3½ inches) high and border areas of taller grass more than 10 centimeters high. The Roadrunners ate ground and flying insects. I did not observe them catching birds or mammals. On only one occasion did I happen upon a reptile — this a snake about .5 meters (1½ feet) long and perhaps too large to be preyed upon by a Roadrunner. I believe that lizard and snake activity was greatly reduced at this time of year and that the Roadrunners were forced to eat smaller prey than they usually eat in spring and summer. I believe that true grasshoppers (Family Acridivae) were a large component of their diet. Grasshoppers seemed to be plentiful and the Roadrunners captured flying ones from time to time with a leap into the air.

During the 280 field hours of this study, daytime air temperatures varied from -10° to 27° C. (14° to 80° F.) and there was no snowfall. Using a 7 x 50 binocular and a 20x spotting scope, I observed the birds between 0800 and 1600 from a vehicle. While watching a Roadrunner, I recorded a note on its behavior every 30 seconds. The 3478 notes that I recorded included comments on standing, walking, and running. If I observed swallowing when the bird remained in an area of constant grass height, I measured the grass height at five two-pace intervals after concluding observations.

Though the Roadrunners did leap into the air to catch flying grasshoppers now and then, they never did so on the 30-second mark at which I noted their behavior. Leaping behavior does not, therefore, appear in this analysis.

I calculated (1) average grass height, (2) swallows per minute, and (3) percentage of time spent standing, walking, and running during 48 periods (each of 3 to 59 minutes) of foraging observation.

Roadrunners walked or ran through the grass, taking insects from the grass or from the air and swallowing them conspicuously. As grass height increased, the Roadrunners stood still less frequently. They swallowed more items per minute in short grass than they did in tall grass.

As grass height increases, a Roadrunner's field of view is reduced and the bird may spend more time moving since it uses less time in surveying the field. In tall grass a Roadrunner appears to be encumbered or discomfited by the grass — a condition that may accompany, or even be brought on by, reduction of foraging efficiency.

Results of my study differ from those of Brownsmith (1977, Condor, 79: 386-388), who, after studying Starlings (*Sturnus vulgaris*), reported that they spent more time standing in grass taller than 6 centimeters (2½ inches) than

in grass less than 6 centimeters tall. This difference in behavior between Starlings and Roadrunners may be explained by the difference in the food of the two species. Brownsmith's Starlings ate seeds as well as insects (personal communication), whereas my Roadrunners ate insects only. In tall grass a Starling is a "gleaner," and may pause from time to time, looking for insects. Roadrunners, on the other hand, are "flushers," detecting and disturbing insect prey as they forage. Roadrunners should spend less time standing still in tall grass than Starlings do if movement of insects is a more important cue for them than it is for the Starlings. The fact that Starlings and Roadrunners use different foraging strategies results in contrasting behavior within the same sort of habitat.

That Roadrunners forage in less than optimal areas (grass height greater than 10 centimeters) is puzzling. Roadrunners should, it would seem, spend all of their foraging time in areas of greatest efficiency (grass height less than 10 centimeters), but repeatedly I saw them foraging in tall grass. Though this may be inefficient for them from a feeding perspective, it may have certain advantages. Tall grass may provide shelter from wind and protection from some predators. Too, the tall grass areas may be the only areas that territorial pairs allow young birds to use.

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GENERAL NOTES

Winter records of White-necked Raven in eastern Beckham County, Oklahoma.— The White-necked Raven *(Corvus cryptoleucus)* probably breeds regularly near Elk City in Beckham County, southwestern Oklahoma, but I have never found its nest in the area. On 13 May and 26 July, 1974, I distinctly heard its calls along a creek in the city itself. The woodlands of the region are inhabited by Common Crows *(C. brachyrhynchos)*, whose *caws* are instantly distinguishable from the guttural *cronks* of the ravens. In general appearance the two species are much alike, for the white of the raven's neck does not often show in the field.

I have come to consider the White-necked Raven a regular fall and winter visitant to a pecan orchard that is just across a small stream from my house in Elk City, and in plain view to me. Here, when the crop of nuts is good, I often hear the birds, especially early in the morning. The pecan crop was unusually good in 1978. That fall and winter I heard the ravens every day from 3 to 10 November, on 5 December, and repeatedly between 24 January and 25 March. I name the dates not from memory but from a diary that I keep.

The pecan crop in 1979 was not good. I did, however, hear the ravens in the orchard between 16 and 28 October, again on 26 December, on 15 January, and from 2 to 19 February. Occasionally one perched on the power-line pole by my house.

The pecan crop was a total failure in 1980. Too, Soil Conservation Service work on the creek created so much disturbance that during the following fall

and winter I saw almost nothing of the ravens and little of the crows. I did record a raven once in late October (exact date uncertain).

The records mentioned above make clear that *Corvus cryptoleucus* does not leave some parts of Oklahoma in winter. The statement in Sutton (1967, Oklahoma birds, Univ. Oklahoma Press, Norman, p. 376) to the effect that there is "no satisfactory January record" for the state may, in other words, say more about the absence of observers than it does about the absence of the ravens.—Ina S. Brown, *106 Sunset, Elk City, Oklahoma 73644, 30 January 1981.*

Robins banded in summer in central Oklahoma and recovered at same locality in winter. On 10 August 1973 I netted and banded (782-70125) an adult female American Robin *(Turdus migratorius)* in my yard at 1416 Huntington Way in Norman, Cleveland County, central Oklahoma. The bird was in good condition, though in heavy molt. Almost six years later—on 4 January 1979—it was observed by Mary Heckendorn "teetering on a piece of iron" in her yard at 828 Cruce Street in Norman. At a feeder close by, later that day, her son Robert found it dead. A recent storm and sub-freezing temperatures had covered the ground and shrubbery with ice, making food difficult to obtain.

I identified the dead robin when given the band number. George M. Sutton, who prepared the specimen (UOMZ 14216) as a skin, found it to be emaciated (weight 55.9 grams), noted that the tarsi and toes were heavily diseased, and considered the skull not fully pneumatized — a decision reached before he knew when the bird had been banded and one suggesting the possibility that extent of cranial pneumatization may not be a wholly reliable criterion in aging *Turdus migratorius.*

On 23 May 1973, again in my yard on Huntington Way, I captured and banded (782-70110) a male robin in full breeding feather that I recaptured twice at the very same place in *mid-winter* (on 14 and 22 February 1976) and again during the breeding season (on 3 May 1976).

The above data clearly indicate that some American Robins that breed in Oklahoma do not follow at all closely the migratory behavior of their species as a whole or that — perhaps depending on weather or the availability of food — they do not move away from their central Oklahoma breeding grounds very far, if at all, in winter. — Warren D. Harden, *2409 Butler Drive, Norman, Oklahoma 73069, 10 January 1981.*

FROM THE EDITOR: The bluebird paper in this issue is timely, for there is widespread belief that *Sialia sialis* is becoming an endangered species. It is to be hoped that Dr. Carter will initiate another three- or four-year study of Eastern Bluebirds on the Carter family's farm near Ada, and that other parts of the state will also receive attention. In further studies careful counts of adult breeding populations and details on two-broodedness and cowbird-parasitism will be in order.

Douglas Mock and D. Scott Wood are to be thanked for their help with editing this issue.—Jack D. Tyler.