

**COMPARATIVE ECOLOGY OF WARBLERS SUMMERING
IN THE OKLAHOMA OZARKS**

BY FREDERICK M. BAUMGARTNER

In the rugged Ozark uplands of northeastern Oklahoma, twelve different warblers spend the summer regularly or occasionally on or near the Little Lewis Whirlwind Nature Sanctuary. The sanctuary lies east of Lake Eucha and a few miles south of Jay, in Delaware County. Local breeding records are known for all but one of these species, the Worm-eating Warbler (*Helmitheros vermivorus*), which apparently does nest irregularly on wooded slopes adjoining the numerous ravines that lead into Brush and Spavinaw creeks. The other species are the Blue-winged Warbler (*Vermivora pinus*), Northern Parula (*Parula americana*), Yellow-throated Warbler (*Dendroica dominica*), Pine Warbler (*D. pinus*), Prairie Warbler (*D. discolor*), Black-and-White Warbler (*Mniotilta varia*), Prothonotary Warbler (*Protonotaria citrea*), Louisiana Waterthrush (*Seiurus motacilla*), Kentucky Warbler (*Oporornis formosus*), Common Yellowthroat, (*Geothlypis trichas*), and Yellow-breasted Chat (*Icteria virens*).



BLACK-AND-WHITE WARBLER

The Black-and-white Warbler was found on all four study areas. This female or first year male was photographed by Joseph A. Grzybowski on 7 September 1981 in McIntosh County.

Description of Study Areas

Oklahoma has been divided into biotic districts by Blair and Hubbell (1938, *Amer. Midl. Nat.* 20:425-454) and into game types by Duck and Fletcher (1943, A game type map of Oklahoma, Div. Wildl. Restor., Oklahoma Game and Fish Dept., Oklahoma City; 1944, A survey of the game and furbearing animals of Oklahoma, Div. Wildl. Restor. and Res., Oklahoma Game and Fish Comm., Oklahoma City). Descriptions by these authors of the Oak-Hickory and Bottomland game types in the Ozark Biotic District are appropriate to the general physiographic and vegetational patterns of the study areas, but small parcels of the Oak-Pine game type are also interspersed therein.

The Brush Creek Valley Study Area covered 16.6 acres (6.7 ha), and provided high quality habitat for many avian species. The clear, spring-fed stream that flowed through it was intermittent during part of the nesting season. Most of this area was a floodplain forest dominated by sycamore (*Platanus occidentalis*), various elms (*Ulmus* spp.), and willows (*Salix* spp.). Two of five small clearings were made in 1982, the other three probably resulted from cultivation many years before. A slope below a steep escarpment that supported a lowland forest of oaks (*Quercus* spp.), hickories (*Carya* spp.) and elms formed the western border. The entire area was part of a huge pasture grazed so intermittently that the vegetation had not been conspicuously changed.

The bottom of a ravine system and part of both slopes made up the Little Lewis Hollow Study Area. Most of its 18.3 acres (7.3 ha) was wooded, but few large trees were present. Oaks, hickories, and shortleaf pines (*Pinus echinata*) dominated the slopes. Crown cover in the narrow floodplain was made up of northern red oak (*Q. rubra*), white oak (*Q. alba*), chinquapin oak (*Q. muehlenbergii*), and black walnut (*Juglans nigra*), and on the slopes above grew a narrow belt of sugar maples (*Acer saccharum*). A small intermittent stream was dry most of the year and no standing water was available on this area. No grazing or cutting had taken place since 1975, but an old house and garden site abandoned in 1976 had left an opening of approximately two acres.

The North Pasture Study Area, an upland pasture dominated by grasses and forbs, comprised 22.5 acres (9.0 ha) of scattered oaks, hickories and shortleaf pines and a few persimmon (*Diospyros virginiana*) thickets. Five large brushpiles made when the pasture was cleared furnished excellent shelter and perches for birds. Outside the pasture fence, a variety of food and cover plants was available in a band of oak-hickory woods and at the heads of five timbered ravines. This pasture had been grazed heavily for short periods from 1968 to 1983. Much of it was "brush-hogged" in the winter of 1983 to check the growth and spread of saplings and blackberries (*Rubus* spp.).

More diverse botanically was the South Pasture Study Area, which consisted of approximately 22 acres (8.8 ha) of grass and 4 acres (1.6 ha) each of open oak-hickory forest and dense second-growth lowland timber. Its unique feature was the large pines and oaks interspersed through most of the grassland. Despite the mowing of woody plants less than about four feet high in January 1983, secondary growth had markedly increased in the grassy stretches. Clearings that were present in the 1970s had also been reduced by the invasion of oak woodlands.

Methods

Relative populations for each species were estimated by taking the average number of singing males on territory and, when possible, locating nests or young just out of the nest for the period 1979-1984. Except where indicated (e.g., Louisiana Waterthrush),

actual nests were not usually located. Methods followed those described for participants in the National Audubon Society Breeding Bird Census (Robbins, 1970, Recommendations for an international standard for a mapping method in bird census work, *Aud. Field Notes*, 24:723-726). The habitat was described by application of the methods used by James and Shugart (1970, A quantitative method of habitat description, *Aud. Field Notes*, 20:727-736) and by the writer's own method of sampling and mapping the herbaceous vegetation on extensive transects throughout each study area. Detailed maps were prepared showing the distribution of vegetation and the location of water, roads and trails that might have influenced the activities of warblers and other wildlife.

Populations and Habitat Use

The largest number of species and those showing the highest density of populations nested in the floodplain forest bordering Brush Creek (Table 1). The Northern Parula fed and sang chiefly in the treetops, less commonly in the middle branches. The average population of 39 males/100 acres was definitely higher than that of any other species. Of 164 contacts, 70 percent were located in the floodplain woodlands, about 20 percent in lowland timber, and the rest in the oak-hickory forest. Only 10 percent of the birds were found in clearings.

The Yellow-throated Warbler nested only in habitats that included numbers of large pines and oaks. Despite the common name given to the subspecies reported in this area (Sycamore Warbler, *Dendroica dominica albifrons*) I never found this warbler in the floodplain forests in the Lake Eucha area, where sycamores abounded. Populations were found locally and in low density. The South Pasture Study Area supported an average population of 6 males/100 acres. The North Pasture, with a more limited growth of large pines and oaks, had an average density of only 2 males/100 acres. Males on territory were found during only three of six nesting seasons. The habitat found in the South Pasture (see description above) was distinctly different from any other in this vicinity of Lake Eucha and may account for the comparatively high populations. Of 130 contacts, 63 percent were in the oak-pine savanna association and 27 percent in oak-pine woods with scattered small openings. Sixty percent of the encounters were in clearings. The habitats that the birds occupied in the North Pasture revealed similar proportions.

The Blue-winged Warbler nests in old clearings and pastures on rare occasions. A male sang vigorously from an old house site located at the edge of a pasture on 1 May 1984. A nest containing four eggs was discovered in bottomland woods along Brush Creek in that study area on 1 June 1987, but failed to rear young (Baumgartner, 1988, *Bull. Oklahoma Ornithol. Soc.* 21:15-16).

The Pine Warbler appeared to have been even more dependent upon pine trees as the major component of its nesting habitat than the Yellow-throated Warbler. This species was not observed in habitats lacking mature pines. Eighty-six percent of 122 contacts were in the oak-pine savanna in either the North or South Pasture; the others were in oak-pine forest. Most of the birds were in clearings. Populations of this species were of moderate size in this locality. The South Pasture Study Area supported an average population of about 6 males/100 acres; the North Pasture Study Area had 4 males/100 acres.

The Prairie Warbler appeared to be a very local summer resident in this locality. I

Table 1. Breeding Bird Counts of warblers in the Little Lewis Whirlwind Sanctuary area near Jay, Oklahoma, 1979-1984 (numbers of males contacted per 100 acres).

Study Area	Brush Creek Valley					Avg.	Little Lewis Hollow					Avg.	North Pasture					Avg.	South Pasture					Avg.				
	79	80	81	82	83		84	79	80	81	82		83	84	79	80	81		82	83	84	79	80		81	82	83	84
N. Parula	36	30	36	42	51	36	39	16	11	22	5	-	5	10	4	-	-	-	-	-	1	6	6	6	6	5	-	5
Yel.-thr. Warbler															2	2	2	3	2	-	2	3	6	3	6	8	7	6
Pine Warbler															5	3	5	3	5	4	4	6	4	8	6	6	7	6
Prairie Warbler															6	4	4	6	8	6	6	4	6	4	5	4	4	5
Blk./wte. Warbler	18	6	12	-	12	12	10	11	16	11	16	8	5	11	-	-	4	4	9	4	4	7	7	7	7	7	-	6
Prothon. Warbler	18	6	18	12	30	12	16																					
La. Waterthrush	36	24	24	30	33	30	30	-	-	-	-	22	-	4														
Ky. Warbler	36	18	30	30	36	30	30	16	22	16	22	22	22	20														
Com. Yellowthroat	-	-	-	6	6	12	4																					
Yel.-br. Chat	6	-	-	6	3	18	6															4	4	5	-	-	5	3

found this species only in active and abandoned pastures. Undoubtedly, it occurred locally in the county. Populations were rather low: 6 males/100 acres on the North Pasture Study Area, 5 males/100 acres on the South Pasture Study Area. All of the habitats occupied consisted largely of woodlands converted to pasture by cutting and clearing of trees and brush. Most of the territories were inactive pastures where the grazing of livestock plus bulldozing set back the growth of trees and shrubs. A few singing males occupied abandoned pastures where saplings and shrubs were beginning to fill up most of the openings. Most of the territories were on upland sites but two in the South Pasture included cut-over ravines and brushy grasslands. Open grasslands with scattered oaks and pines constituted the habitat in which 61 percent of the contacts were made: 18 percent were in cut-over oak-hickory woods with some small openings, and 21 percent in cut-over wooded ravines. Sixty-eight percent of the records were in openings and all the contacts were within 250 feet (75m) of openings.

The Black-and-white Warbler was more adaptable in its nesting habitat requirements than most of the warblers found in this locality. Of 112 contacts, 22 percent were in the floodplain forest, 41 percent in lowland forest, and 37 percent were located in oak-hickory forest. About 13 percent were in openings. The birds spent much of their time feeding on limbs and trunks of trees at low to medium heights. Populations were moderate to low, ranging from 10 males/100 acres in Little Lewis Hollow to 4 males/100 acres in the more heavily wooded portion of the North Pasture Study Area.

The Prothonotary Warbler was limited largely to the floodplain forest with running or standing water. The Brush Creek Study Area was the only one occupied by this species. As indicated in Table 1, population densities averaged 16 males/100 acres. Most of the birds observed were feeding in the lower branches or on the ground near water while singing males selected perches of moderate height or sang on the wing. Of 56 contacts, 93 percent were in the floodplain forest, 7 percent in the lowland forest association. A surprisingly large proportion of encounters (21 percent) were in open areas or at borders between clearing and forest. This relationship may have been deceptive since three of the five clearings on the area extended to the edge of Brush Creek.

The Louisiana Waterthrush did much of its feeding near shallow water. All of the 16 nests found were under low rock ledges, logs or roots within 3 feet of the ground. A few of the singing males were in trees at the 10-25 foot (3-8m) level. Populations at Brush Creek were rather stable (average: 100 males/100 acres) despite great variations in the amount of water in the creek. Surprisingly, a pair of Louisiana Waterthrushes apparently nested on or near the Little Lewis Hollow Study Area in 1983. Two singing males were recorded on each of two dates, and on 7 June two adults and one chick were found. Two adult birds, probably the parents of the chick, had been seen on three occasions at a small pond about 500 feet (150m) from where the chick was seen. Data on the distribution of this species clearly indicate a close relationship with the floodplain forest and water. Of 124 contacts, 116 (94 percent) were in the floodplain forest with only 8 (6 percent) in the lowland forest. Practically all birds were found in or close to water. The birds occupying Little Lewis Hollow were found chiefly on the floodplain but occasionally in the upland oak-hickory woods. The number of contacts there (9) was too small to have much significance.

The Kentucky Warbler was well adapted to the floodplain forests and also to the lowland forests. The Brush Creek Valley population was, on the average, 30 males/100

acres. The average number of breeding birds at Little Lewis Hollow was 20 males/100 acres. On the Brush Creek Valley Area, 89 percent of the contacts were in the floodplain forest, 9 percent in lowland timber, and 2 percent in the oak-hickory association. At Little Lewis Hollow, 72 percent of encounters were in the floodplain or lowland forest and 28 percent were in the oak-hickory woods, usually well downslope near the riparian woods. It is doubtful that this species was nesting in the oak-hickory association, because no scolding adults or young birds were found there. Of the 209 contacts there, 34, or 16 percent, of the birds were found in clearings in the woods, usually in the shrub layer or on the ground. Occasionally, males sang from higher perches.

The Common Yellowthroat was an uncommon nesting bird in the Lake Eucha (Brush Creek) area. The number of males averaged 4/100 acres. One or two singing males were found regularly during three of the six years, but females were rarely seen. Singing males and a few sight records were concentrated in the shrubs and forbs bordering one old clearing and another made before the 1982 nesting season. Of 16 contacts, all were on the floodplain, with the majority in openings and a few in second growth.

The Yellow-breasted Chat was found regularly in both upland and lowland habitats. All territories defined included at least some shrubs and sapling trees resulting from recent cutting or abandonment of fields and the subsequent regrowth of woody species in pastures. In openings between trees and shrubs, there was a fairly dense growth of forbs and grasses. In the floodplain and lowland habitats at Brush Creek, 63 percent of the 22 contacts were in the narrow zone where the floodplain forest graded into young trees and shrubs invading more open pastureland. Thirty-five percent were within clearings that supported scattered trees and shrubs. One bird called from an oak-hickory slope bordering the study area. In the South Pasture, chats occupied two different types of habitats. Nearly half of the birds contacted were associated with the pasture, living in or near the shallow ravines where there were dense to open secondary growths of trees, shrubs and vines. About the same number of birds were found in a habitat of cut-over oak-hickory woods with scattered openings overgrown with saplings, bushes and tall grasses. Three of the 29 birds contacted were located in open pastures with a few trees. Populations of Yellow-breasted Chats (Table 1) were not high in this area, averaging 6 males/100 acres at Brush Creek Valley and 3 males/100 acres on the South Pasture Study Area. Of 34 contacts on the study areas, 41 percent were in or very near openings within the floodplain timber, 26 percent were in lowland woods, 24 percent were in the floodplain forest proper, and 9 percent in or on the borders of openings in the oak-hickory forest. In several other habitats, these birds were found regularly in abandoned pastures that had grown back to patches of scattered small oaks and hickories, interspersed with areas of grasses and forbs.

Summary and Conclusions

The ten species of warblers that nested in the vicinity of Lake Eucha near the western edge of the Oklahoma Ozarks occupied a variety of ecological situations. Several species that occupied the floodplain forest (Northern Parula, Louisiana Waterthrush, Kentucky and Prothonotary warblers) had the highest population densities. All of these except the Prothonotary Warbler nested in smaller numbers in the lowland forest. Floodplain and lowland clearings attracted small numbers of nesting Common

Yellowthroats and Yellow-breasted Chats. The oak-hickory woods were favored by Black-and-white Warblers. Yellow-throated, Pine and Prairie warblers occupied more open habitats. The Yellow-throated Warbler preferred very open stands of mature pines and oaks. Pine Warblers occupied woods dominated by mature pines. Activities of the Prairie Warbler were restricted to cut-over and abandoned pastures containing stands of saplings and clearings.

Most of the habitat suitable for nesting warblers in this area was grazed by livestock. Four pastures in the area subjected to almost complete removal of trees and shrubs supported no nesting warblers. Moderate grazing and retention of a few clumps of trees and shrubs to provide shelter for livestock and wildlife will assure suitable habitats for a number of nesting species. The clearings of small patches of forest land (1-3 acres) stimulated an increased use of the openings by the Kentucky Warbler, Yellow-breasted Chat and Prairie Warbler, but may also have increased numbers of Brown-headed Cowbirds (*Molothrus ater*). The future of those warblers nesting in the floodplain forest appears bleak because these woods are rapidly being converted to pastures and croplands.

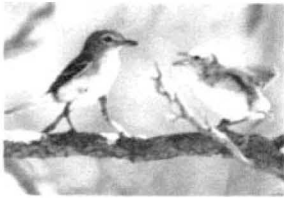
185 WITHERSPOON RD., ATHENS, GEORGIA 30606, 15 JULY 1991.

GENERAL NOTES

Yellow-throated Vireo nest in Cimarron County, Oklahoma.—On 13 June 1986, I discovered a pair of Yellow-throated Vireos (*Vireo flavifrons*) attending two of their young at a spot about 17 miles northwest of Boise City in Cimarron County, Oklahoma. The juvenile vireos were recently fledged and not yet capable of flight. I photographed them and banded one of the young birds (USFWS band #890-79067).

At about 1915 the previous evening, I had investigated a small but dense thicket of close-set hackberry, soapberry and cottonwood trees near a small stream. Although cattle had removed most of the undergrowth below four feet, the trees themselves were enmeshed with luxuriant tangles of grapevines. Scarcely a quarter-mile to the north lay the Cimarron River.

As I walked by the thicket, I paused for a moment to "squeak," in an attempt to attract birds. Immediately, two small, yellowish vireos appeared and began to scold and dive toward me. Detailed descriptions from my field notes read: "bright yellow throat turning white on belly, two white wingbars, heavy bill and yellow 'spectacles.'" Obviously, I had invaded their breeding territory, but no nest or young could I find, though I searched for several minutes. Because this locality is so far west, I suspected that these vireos belonged to a typically western species. But when I consulted a field guide, the above description matched very closely that for the Yellow-throated Vireo, a species which ordinarily nests at least 200 miles east of Cimarron County!



An adult Yellow-throated Vireo and its chick, photographed about 17 miles northwest of Boise City, Cimarron County, on 13 June 1986, by John S. Shackford.

The next day (13 June), I found two fledgling vireos in the little grove. They had not left the nest more than a day or so before, and were perched eight feet up and about 25 yards apart. One was resting on a dead