Fall-Winter Habitat Use and Food Habits of Doves in Southwestern Oklahoma

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Abstract: Mourning dove (*Zenaida macroura*) behavior, habitat use, and food habits were studied in southwestern Oklahoma during fall–winter. Birds present during the September–October hunting season were summer residents and migrants. They formed large feeding flocks containing up to 1,000 birds, flew 3–12 km from night roosts to feeding sites, and fed in morning and late afternoon. These doves fed in wheatfields when waste grain was available; otherwise, they fed on haygrazer (sorghum x sudan grass), sunflower (*Helianthus* sp.), and weed seeds. Doves day-roosted in ravines or uplands near the stock ponds where they drank at midday. At evening they drank at other stock ponds before night-roosting in river bottom or upland trees and thickets. Winter residents in smaller flocks (15–300) roosted and watered close to their feeding fields, and at the roosts they perched low in the trees or sat on the ground. Wintering birds spent longer periods feeding and evidenced little flying that could be considered unnecessary to acquiring food. Their efforts seemed directed at conserving energy and maximizing food intake. The principal winter food was haygrazer. Habitat components used by winter-resident doves were fields of haygrazer or sorghum close to surface water and roosts.

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Research needs for proper management of mourning doves (*Zenaida macroura*) include information on winter habitat and populations (Tomlinson, R. E. 1966. A long-range research and management program for mourning doves. Unpubl. Rep., U.S. Bur. Sport Fish. and Wildl. 144pp.). Oklahoma is in the northern portion of the winter range for mourning doves within the Great Plains. Small flocks of doves are seen during winter in most counties of Oklahoma but among the larger populations are those of a few southwestern counties where habitat and foods are suitable (Morrison and Lewis 1975). The doves that winter in Oklahoma probably nest in the northern Great Plains but this has not been confirmed. Doves that nest in western Oklahoma spend the winter in Texas, Mexico, and Central America (Lewis and Morrison 1978).

We studied doves from June 1972 through December 1973 in extreme southwestern Oklahoma. We did not attempt a detailed analysis of dove behavior but emphasized describing types and routines of daily activities (feeding, roosting, habitat use) as a foundation for more detailed research planned for the future. The research objectives that relate to this paper were to describe habitat use, behavior, and food habits, and to determine the timing of arrival and departure of the winter population.

Methods

The study area (377 km^2) extends 29 km east-west and 13 km north-south around the community of Eldorado (elevation 430 m) in Jackson County of southwestern Oklahoma. We chose a large study area in order to detect individual flock movements and to observe activities of doves in a variety of habitats. The area borders Texas along the Red River. Jackson County has a continental, warm-temperate, subhumid climate. The average annual rainfall is 63.5 cm. December, January, and February are the coldest months, with a 3-month average of 6.1 C. Prevailing winds are southerly. During winter the wind shifts widely, causing extreme variations in temperature. Frequent cold fronts decrease the temperature rapidly and cold weather usually lasts 2 or 3 days until southerly winds again predominate.

Cropland, pasture, and relatively unproductive broken land of rough ravines and rocky outcrops are present in the study area. Major crops included wheat, cotton, sorghum, and sorghum × sudan grass which locally is

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called haygrazer. Haygrazer was occasionally cut and baled, but more often was left standing in the fields and used as cattle pasture. Several cattle feedlots were present in the area. Weeds grew abundantly in pastures, along roads, and in the wide sandy river bottom. Some native grass pastures contained light-to-heavy overstories of mesquite (*Prosopis glandulosa*) and other trees, and lotebush (*Condalia obtusifolia*) shrubs. Sand dunes that extended up to 3.5 km northward from the river were managed mainly as pastures and contained many chittamwood (*Bumelia lanuginosa*), hackberry (*Celtis* sp.), lotebush, and sandsage (*Artemisia filifolia*). Salt cedar (*Tamarix gallica*) was abundant on the wide floodplain of the Red River. The land was sparsely inhabited, farm houses were several kilometers apart, and the only notable communities, Eldorado and Olustee, contained about 700 and 460 people, respectively.

Descriptions of dove behavior and notable phenomena were recorded in regularly scheduled observation periods and at opportune times during other project activities. We captured doves in Thompson traps (Reeves and Geis 1968), modified to the design of Dyer (1973), baited with proso millet or a mixture of wheat and millet. Traps were placed in groups where doves congregated to feed or roost. These methods and baits had been the most successful for trapping doves in the summer in western Oklahoma (Dyer 1973, Lewis and Morrison 1973). Doves were trapped and leg-banded in the summer of 1972. They were leg banded and color marked in the summer of 1973 and the winters of 1972–73 and 1973–74. Each marking season and trapping location was identified by a combination of marker colors and position of patagial streamers on the doves' wings. Observations of the color-marked birds, and recapture of the doves only leg banded, made it possible to monitor activities of individual birds and flocks.

Doves were counted weekly at 1600–1900 hours on 4 routes from early September to early November. Observers drove about 40 km/hour and recorded all doves seen. These counts were used as indices to population trends. After early November, doves concentrated at a few sites so road counts were discontinued and we attempted to count individual flocks after they were deliberately flushed from feeding sites.

Doves were regularly collected in the study area in 1972–73 for food habits analysis and for other research not reported in this paper. Dove crop contents were dried, identified, and weighed. During fall-winter of 1973 we did not collect doves but did record their feeding activities. Readers are referred to Morrison and Lewis (1975) for more detailed descriptions of methods.

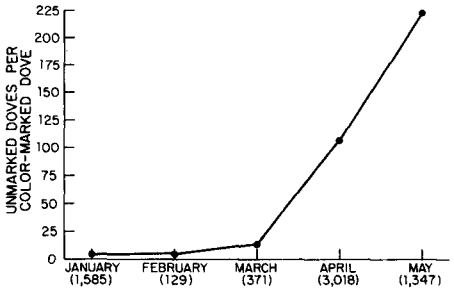

Figure 1. Ratios of unmarked to color-marked doves observed monthly in southwestern Oklahoma, 1973.

Results

Data from Trapping and Census

During June through August 1972, 3,067 doves were trapped and leg banded. In the winter of 1972–73 we leg banded 536 doves and color marked 318 of these birds. We leg banded and color marked 2,226 doves in the summer of 1973 and 262 doves in the winter of 1973–74.

Based on our weekly censuses and observation of color-marked doves, more than 95% of the summer population left the area by mid October. The winter population arrived in November and began to depart in February. The nesting population arrived in March. Very few doves color marked in winter remained in summer and few summer residents remained in the area in winter (Table 1 and Fig. 1). Only 5 doves leg banded in the summer were recovered in the study area the following winter. One dove leg banded in winter was recaptured the following summer in the study area (Table 2).

Doves color marked in winter usually spent all winter in company with the flock in which they were first trapped. They were regularly seen in the roost-feeding field-drinking site complex where their flock moved. Doves color marked in 1972, and seen again in 1973, had returned to the study area vicinity where they were first captured. Seventy-five doves were recaptured 2 or more times and these doves were in the vicinity of their original capture site even when weeks had elapsed since the original capture.

Table 1. Sightings of Color-marked Doves, March 1973 through December 1974

Season of Marking	Total Color-Marked	Other Months Observed In			
		Mar–May	Jun–Aug	Sep–Oct	Nov–Dec
Winter 1972–73	318	51	4	9	2
Summer 1973	2,226			65	5

Table 2. Band Returns from Doves Leg-banded in One Season and Recaptured in the Study Area in a Different Season, Eldorado, Oklahoma Vicinity, 1972–74

Band Number	Date Banded	Date Recovered	Interval (days)
	Summer banded	Winter recovered	
1223–90030	12– 8–72	26– 2–73	198
1203–98147	23– 7–72	22– 1–73	153
1183–15531	11– 6–73	4– 1–74	207
1203–72914	6– 8–73	16– 1–74[a]	163
1283–21169	25– 8–73	18–12–73	115
	Winter banded	Summer recovered	
1223–91217	16–11–72	8– 6–73	204

[a] Recovered by a hunter near Quanah, Texas, 8 km south of the study area.

Behavior Contrasted Between Fall and Winter

Fall behavior of summer-resident and migrant doves differed markedly from behavior of winter-resident doves. Doves present in September–October were a combination of summer residents and migrants. They traveled in large flocks and interacted socially as flocks more than did the winter residents. During the first fall (1972) these behaviors apparently were influenced by the preceding 2 years of drought and by the existing warm fall weather. Many upland ponds had dried up and the birds flew greater distances to drink. They roosted at midday near these sources of water, but night roosts were usually an additional several kilometers from the evening watering site. There were fewer night roosts than day roosts and night roosts were in secluded river bottom thickets. Doves perched in the highest branches of these night roosts. Doves may have preferred the secluded river bottom roosts because the hunting season was in progress.

Winter-resident birds roosted and watered close to their feeding fields, thereby omitting the longer flights evidenced by doves in September–October. Winter birds roosted on the ground or low in trees and shrubs where they escaped some wind and may have benefited from ground temperatures higher than air temperatures. Doves in winter spent longer periods feeding and evidenced little flying that could be considered unnecessary to food acquisition. Their efforts seemed directed at conserving energy and maximizing food intake.

General Behavior and Habitat Use 1972–73

From early September until about 7 October, doves fed 3–12 km north of the Red River where they roosted at night in large communal roosts (Fig. 2). Flocks of 30–50 doves began leaving the roosts each morning at about 0700 hours to feed in wheatfields. Many flocks left within the first 5 min

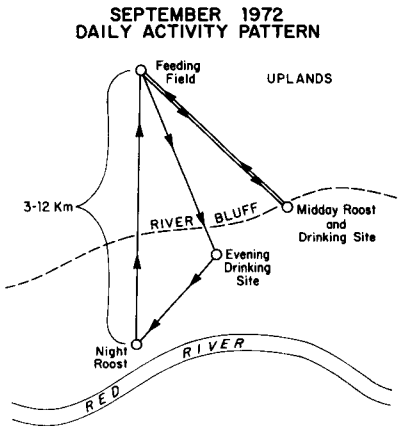

Figure 2. Daily behavior pattern of migrant and summer-resident dove flocks in southwestern Oklahoma.

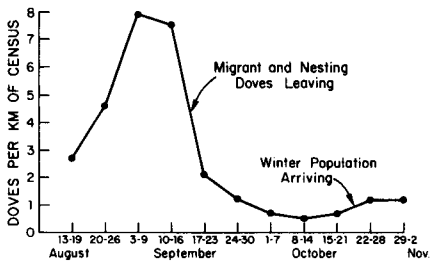

Figure 3. Mourning doves observed per kilometer of census route, southwestern Oklahoma, 1972.

then for another 25–30 min small groups of 10, pairs, and singles followed the large flocks.

There were 2 daily feeding periods during which doves often formed flocks that exceeded 1,000 at choice locations. Wheatfields were favored feeding sites until late September, regardless of whether it was stubble-mulched, or plowed and drilled for next year's crop. September was hot and dry so the planted wheat did not sprout. A few sunflower (*Helianthus* sp.) patches and haygrazerfields were used, but they were visited much less frequently than the wheatfields. After 25 September, doves began feeding on haygrazer, and in cottonfields they ate pigweed (*Amaranthus* sp.) and other weed seeds.

Feeding activity peaked between 0800 and 0900 hours, and then the birds virtually ceased feeding until about 1600 hours. The doves day roosted in dense mesquite thickets around ponds in deep ravines. They drank at the ponds and perched nearby in low branches about 1.5 m above ground or sat on the ground in shade. Most of the ravines were oriented north and south

and led to the Red River. If there was any wind on the uplands, a breeze tended to move down the ravines. Cooler temperatures associated with the breeze, plus nearby water, may have been factors that attracted doves to these ravines in heat of midday. The evening peak of feeding occurred between 1700 and 1800 hours.

Feeding intensity diminished until about 1900 hours when the entire population flew almost simultaneously to drink at ponds near the river or at backwater eddies along the river. Doves began moving south toward several main flight pathways leading to the Red River floodplain. A concentrated mass of birds proceeded along these flight lines leading to drinking sites. Each flight pathway was directed toward a stock pond in any one of several large ravines that cut through the bluffs of the north side of the Red River. Ponds where they drank in evening were not the same as those used near day roosts.

From about 1900 to 1945 hours the doves went on to roost along the river in thickets of hackberry, chittamwood, soapberry (*Sapindus drummondi*), and salt cedar. Several such roosts were present along the Red River, but most of the population stayed in only 2. They perched in the highest branches of trees, crowding close together. This night-roosting pattern continued through early October. The roosts each contained about 20,000 doves.

In early October, individual bird activity seemed greater during the midday resting period when cooler weather and light rains prevailed. The population of doves diminished considerably (Fig. 3) and by 14 October the distinct mass morning and evening flights had ended. Cool weather apparently stimulated departure of many of the summer-resident and migrant doves.

After 8 October, doves fed predominantly in haygrazer although some birds still visited wheatfields, sunflower patches, and cottonfields to glean seeds. Many doves began roosting at night in uplands in the southern half of the study area. The morning feeding period was longer, lasting from 0700 to 1000 hours. At midday, instead of moving to pond areas in ravines, doves flew into trees around feeding sites. Day roosting mainly occurred in stands of mesquite, soapberry, and osage orange (*Maclura pomifera*).

Doves did not fly about much during morning and evening feeding periods. They apparently stayed on the ground to avoid the strong winds that persisted throughout the area. Few brids went back and forth to nearby perches or flew between feeding fields. In the afternoon, feeding activity still peaked between 1700 and 1800 hours, but doves left to water and to roost individually, or in small groups, throughout the latter part of the day. Feeding flocks were smaller. Groups of 40 to 50 were common and flocks of several hundred birds were no longer seen. After the evening feeding period, doves still went to drink before roosting but now they visited upland ponds. Doves roosted at night in mesquite thickets around the feeding fields or, at

3 locations, roosted on the ground in cottonfields (2 flocks) or haygrazerfields.

Numbers of doves increased in late October indicating that the wintering population was starting to arrive (Fig. 3). The population was about 1,225 during November or slightly over 3 doves/km^2 (Table 3). With 1 exception, a cornfield, all the flocks were associated with haygrazerfields. At the cornfield, doves fed on pigweed and on millet at a trap site. Flight distances to feed, drink, and to roost were usually 1–2 km in November. For example, at 1 site flocks of 40–50 birds flew about 1.6 km to drink at a pond. From there they flew 2 km to a night roost. Another flock drank at a pond adjacent to their haygrazerfield and then flew about 1 km to roost in a cottonfield. A third flock flew 1.2 km to a pond, drank, then returned to night roost at their feeding field.

Between 1 and 18 November, the doves still maintained peaks of feeding between 0800 and 1000 hours and again from 1700 to 1800 hours, but total feeding periods were longer than in September. Midday roosts were thickets near the feeding areas where doves perched on low limbs or beneath trees, with feathers fluffed out against the cold.

Light snow fell on 19 November and again on 29 November. During late November birds fed intermittently through each day but feeding intensity peaked in late afternoon. Doves no longer left the feeding site a few at a time at the close of the afternoon feeding period. Instead, at about 1715 to 1720 hours (daylight saving time had ended on 29 October) doves flew almost simultaneously and moved in large flocks to roost. They no longer drank at previously favored ponds, but instead they used rain pools in the feeding and roosting sites.

The first week of December was cold. Day-roosting doves stayed close to the ground with their feathers fluffed and in full sunlight as though trying

Table 3. Population Estimates of Winter Dove Flocks, 1972–73

Major Concentration Site	Average Flock Size By Time Intervals		
	1 Nov–15 Dec	15 Dec–15 Jan	15 Jan–28 Feb
1		100	35
2	175	100	25
4	200	75	10
7		100	25
9	300	200	50
11	200	50	
14	150	75	25
17	125	50	15
18	75	50	
Totals	1,225	800	185

to maximize absorption of solar heat. Some sat on the dead limbs of trees that had been pushed over during land clearing. Others sat in depressions in the ground, at the windward edge, apparently avoiding cold wind.

Flocks containing color-marked birds stopped using 3 haygrazer sites in December, presumably because cattle had eaten most of the grain. One of these flocks moved to 2 other feeding sites 0.4 and 1.2 km away. In the other 2 instances the birds were not observed again in the study area. A flock new to the study area arrived 4 January and settled into a haygrazerfield and a mesquite grove roost about 0.8 km distant. Another new flock containing no color-marked or leg-banded doves appeared at a haygrazerfield in mid-January; this flock roosted day and night in mesquite 0.4 km north of their feeding field. They generally roosted on lower limbs within 2 m of the ground. The departure of some flocks containing color-marked and leg-banded doves, and the arrival of other flocks not previously present that winter, substantiated some mobility of the winter population.

From mid December until early January the dove population in the study area was about 800 (Table 3). Light snow fell on 3 January and doves seemed reluctant to fly. Many fed on weed seeds in bare spots among the roost sites or on haygrazer at feeding fields. Others huddled on the lee side of buildings and tumbleweed (*Amaranthus graecizans*) piles.

On 5 January a blizzard with high winds brought sleet which froze into a solid sheet of ice over the ground by 6 January, then about 10 cm of snow covered the ice. Low temperatures and wind persisted for several days and thousands of doves died in western Oklahoma. We examined 66 doves that died during and after the storm. During the blizzard doves did not move except to get inside old sheds and barns, under hedgerows and tumbleweeds, or into ravines and cut banks to escape the storm. They did not appear to feed, became torpid, did not respond to human presence, and could be picked up and handled at will.

After 7 January, doves gradually reappeared to feed at trap sites, cattle feedlots, and a few wind-swept spots. The snow and cold persisted through 11 January. Doves day roosted on the ground except where they perched on rafters or ledges in barns and other buildings. At night they found shelter in buildings and dense cover. After 14 January, dove populations were greatly depleted. Based on average flock-size estimates, the study area population had declined from about 800 to 200 doves. Some birds had probably moved south but the principal cause of decline was thought to be mortality during and after the blizzard (Morrison and Lewis 1974). Three haygrazerfields supported the only flocks of doves remaining in the study area.

Preblizzard patterns of movement and activity were resumed as temperatures increased in late January. A flock that formerly roosted in a cottonfield began night roosting in salt cedar in the Red River bottoms 1.6 km dis-

tant. The latter flock continued to day roost in mesquite near their feeding field. At another site, doves were again roosting in soapberry, oak (*Quercus* spp.), and dead, fallen tree tops.

By mid February, doves were roosting at night in trees scattered throughout the area. Flocks had broken up, birds were dispersed, and many pairs had formed. Daily peaks of feeding were no longer evident and many doves were seen flying cross-country as though northward migration was underway. A flock consisting of unmarked doves, apparently new arrivals in the study area, appeared in late February; this flock may have been northward migrants.

Food Habits, 1972–73

Foods used most heavily throughout the collecting period, in order of amount eaten, were haygrazer, wheat, prickle poppy (*Argemone* sp.), panic grasses (*Panicum* spp.), grain sorghum, pigweed, sunflower, spurge (*Euphorbia* sp.), and wild bean (*Phaseolus* sp., *Strophostyles leiosperma*) (Table 4). The use of each species varied from month to month. Only haygrazer was ingested in substantial amounts in most months. Haygrazer was the primary winter food and the other species were of secondary importance.

Wheat constituted the major dove food in September, 1972, then decreased markedly in October, a phenomenon noted early in northwestern Oklahoma by Carpenter (1971). By October, all wheat fields had been plowed and harrowed several times, eliminating spilled wheat available on the ground. The increased use of wheat in January resulted from doves consuming cattle rations at feedlots during severe winter storms.

Table 4. Comparative Monthly Ingestion of 9 Foods Most Frequently Eaten by Mourning Doves in Southwestern Oklahoma, September 1972 through March 1973

	% Total Weight						
Food Items	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Haygrazer (*Sorghum bicolor* X *Sorghum sudanense*)	23	27	33	96	76	15	52
Wheat (*Triticum aestivum*)	31	2	7	T	17	T[a]	1
Pricklepoppy (*Argemone* sp.)	19	10	T	T	1	1	T
Panic grass (*Panicum* sp.)	3	16	33		T	5	T
Maize (*Sorghum* spp.)		3	4			76[b]	
Pigweed (*Amaranthus* spp.)	4	14	13	1	T	T	T
Sunflower (*Helianthus* spp.)	10	8	8			T	T
Spurge (*Euphorbia* sp.)	4	17	T	T			
Wild bean (*Strophostyles leiosperma*)	2	2	T			1	44
Others	4	1	2	3	6	2	3

[a] T = trace (<1%).
[b] See discussion in the text.

Panic grass, pigweed, and sunflower seeds augmented the haygrazer eaten in November but in the critical winter months of December through January doves subsisted primarily on haygrazer. Wild beans were important foods only in March. So few doves were present (about 200) in February that it seemed advisable to collect doves outside the study area. The comparatively large amount of sorghum consumed in February resulted from collecting doves in neighboring Greer County. Doves there had roosting-feeding patterns around sorghum fields. These patterns were very similar to those observed around haygrazer fields within our study area.

General Behavior Fall–Early Winter 1973

Precipitation in the spring and summer of 1973 was much greater than in the previous 2 years. Weeds were abundant in pastures, roadsides, and other uncultivated areas. Sunflowers constituted a visually higher proportion of these areas than in 1972. Several farmers had not had sufficient cattle feed in 1972 so in 1973 they planted haygrazer in fields that contained cotton or wheat in 1972. Soil moisture was suitable for rapid growth of September-planted wheat and dense growths of wheat soon made the fields unattractive to doves. Doves fed almost entirely in numerous fields, patches, and roadside strips of sunflowers, various weeds, and haygrazer-fields.

Contrasted with the 1972 field season, fewer doves were present when fall observations began on 10 September. The doves were scattered over the study area in smaller flocks that rarely exceeded 250 birds (many flocks in 1972 contained 500 doves and some contained 1,000). The large 1972 flocks were almost entirely concentrated in the southern half of the study area (perhaps because they roosted along the Red River at night). The dispersed, small flocks in 1973 were common over most of the area and they night roosted in the uplands.

Throughout September 1973, doves persisted in feeding from 0700 to 1000–1030 hours, then again from 1500–1600 hours until 1900. Their arrivals and departures from feeding areas were not as abrupt and discrete as were similar movements in 1972. Flocks of 15–25 doves were scattered over more numerous feeding sites. The funnels of flight to night roosts at the river did not recur in 1973. (Observations since 1973 indicated that the large flocks of 1972 and the evening flights to roost in the river bottom are typical of most Septembers.)

Doves roosted at midday in trees near the feeding sites. They showed no preference for mesquite, ponds, or ravines as they had the previous year. September 1973 was cooler and moister than September 1972. Rain pools provided water near feeding sites. Lower temperatures and availability of water may have reduced attractiveness of the cool ravine day-roosts used in

1972. After the evening feeding period, doves dispersed gradually to roost without flying to drink at a pond. Night roosting (flocks of 25–50 birds and smaller) also took place throughout the uplands. However, 1 large roost of 500 birds in 20-m-height soapberry did exhibit a large-scale roosting flight. Doves entered the roost from all directions at dusk and left relatively quickly at dawn. After a cold front passed through on 16 and 17 September, that roosting flock diminished to about 20 birds.

During the first 2 weeks of October, feeding periods became longer and less peaked in morning and evening. Flock size increased. Flights between roosts and feeding areas continued to be prolonged and irregular rather than in discrete mass movements. After mid October, feeding flocks were present that persisted into winter. Some of the favored feeding places of 1972 no longer existed because of changes in the crops grown. However, 1973 flocks used 4 feeding sites that were used in 1972 and 2 sites not used in 1972. Haygrazer was the main food. Haygrazer fields that had been lightly grazed by cattle were used more than uncut or ungrazed haygrazer. Doves occasionally fed in sunflower patches.

A typical flock night roosted on the ground in a haygrazerfield. At 0715 to 0730 hours they flew about, alighting to feed at various locations in the field. At about 0845 they moved to the yard of an abandoned farm west of the haygrazer field where they perched on, or under, soapberry trees. Feeding was irregular through midday and then steady from 1500 to 1730 hours. At dusk they flew 1.8 km to drink at a pond, then returned to the haygrazerfield to roost. This pattern continued through the mild weather of November and December.

Conclusions

The habitat components used by winter-resident doves were fields of haygrazer, or sorghum, in close association with surface water (rain pools or stock ponds) and roosts. Roosts varied with the severity of weather but included thickets or hedgerows of hackberry, chittamwood, mesquite, osage orange, and soapberry, and dense ground cover for extreme cold periods. These feeding, drinking, and roosting sites were close together (0.1–2 km). If agricultural practices should change in the area, and the production of haygrazer and sorghum be discontinued, it is doubtful that southwestern Oklahoma would support many doves in winter.

Winter-resident doves arrived in the study area after the September–October hunting season. The nesting ground source of these doves is unknown. If they come from northern Great Plains states or southern Canada they may not be exposed to hunting. Banding studies should be continued to

determine the source of these birds and other dove populations wintering in Oklahoma. These populations might provide a short early winter hunting season but further studies are necessary before such a season could be recommended.

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