PRELIMINARY OBSERVATIONS ON MOURNING DOVES WINTERING IN SOUTHWESTERN OKLAHOMA

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In 1972, a 2-year study was begun to analyze wintering characteristics of mourning doves (*Zenaida macroura*) in western Oklahoma. Highlights of the 1972-73 winter observations are reported. Doves in Jackson County, Oklahoma formed permanent flocks that remained at selected roost-feeding sites. During and after the ice and snow storm of 5 and 6 January 1973, many doves died in shelterbelts, tumbleweed rows, and old farm buildings where they had sought shelter. Of 796 doves captured during the winter of 1972-73, only two were recaptured from the 3,067 doves banded in the area during the summer of 1972.

The intensity of research on dove biology in North America has never been commensurate with the economic and recreational importance of the species (1). Wight (2) observed that research and management on mourning doves were declining in the plains states although the importance of species was growing. Tomlinson (unpublished report, U. S. Bureau of Sport Fisheries and Wildlife, 1966) noted that studies of winter habitat and methods of inventorying winter populations were lacking. He believed research was needed to improve winter habitat, relate winter populations to hunting regulations, and show whether doves had differential age and sex preference for various winter areas.

Mourning doves have apparently extended northward the limit of their winter range. About 1900, doves wintered in southern Michigan, where some lose toes to frostbite (3), a phenomenon also reported in Illinois (4). Little information has been obtained on the winter ecology of mourning doves near the northern limit of winter range in any part of the United States. Chambers et al. (5) studied sex and age ratios and origins of banded birds recovered among wintering doves in north-central Missouri. Hennessy and Van Camp (6) studied flock size, feeding areas, roosting areas, origins, and movements of mourning doves wintering in northern Ohio.

Concern for winter mortality among doves is not restricted to the northern boundaries of their winter range. Heavy mortality of doves occurred during an ice storm that swept over the southern states in 1951. Many doves were killed in Tennessee (7, 8), Louisiana (9), and Texas (10). Hanson and Kossack (5) stated that declines in nesting populations resulted from the 1951 die-off. Mortality was attributed to lack of food caused by the ice rather than low temperature.

Doves winter in Oklahoma, especially in the southern part of the state. In western Oklahoma, which is subject to low temperatures, severe winds, and snow storms, doves may experience high mortality. Game Rangers of the Oklahoma Department of Wildlife Conservation found several hundred dead doves in shelterbelts, farm buildings, and cattle feedlots in Greer County after severe weather in January 1966 (11). If doves wintering in Oklahoma frequently experience high mortality, we must be concerned about the nesting populations affected by it. Chambers et al. (5) and Hennessy and Van Camp (6) recovered in winter large numbers of banded birds that were banded in the areas during preceding summers. Doves wintering in Oklahoma probably include some locally produced birds, but superficial observations suggest that nesting and locally hatched doves migrate, and the wintering doves come from other states.

In studying the characteristics of doves wintering in Oklahoma, our objectives were to identify their origin, describe their behavior and physical characteristics, and analyze their responses to variations in weather. Because it would be necessary to capture a large sample of doves, another objective was to test the winter-time efficacy of a trapping method commonly used in summer.

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METHODS

The study area was established around Eldorado, Jackson County, because doves wintered there and because doves captured and marked there in the previous summer might be recaptured should they also constitute the winter population. Different characteristics of terrain and land use revealed four major habitat units within the area; therefore, information on wintering doves was recorded by unit. The overall area included: fields of wheat, cotton, and haygrazer (*Sorghum bicolor* X *S. sudanensis*); overgrazed pastures containing impoverished grasses, abundant weeds, and various densities of mesquite trees (*Prosopis glandulosa*) and lotebush shrubs (*Condalia obtusifolia*); various amounts of rough, broken ravines and rocky outcrops supporting little vegetation. Unit 1 (north of Eldorado) is rolling pasture and wheat land intersected by wide, flat-bottomed ravines. Unit 4 (northwest of Eldorado) is mostly flat crop land, amid which a 4-square-mile copper-bearing rocky outcrop is presently being strip mined. Units 2 and 3 (southwest and southeast of Eldorado, respectively) border Texas along the Red River. The river floodplain is edged with bluffs to the north of which large sand dunes extend one to two miles. Managed as pastures, the dunes contain much chittamwood (*Bumelia lanuginosa*) hackberry (*Celtis* sp.), sand sage (*Artemisia filifolia*), and lotebush. North of the dunes are sandy crop lands and mesquite pastures. Several deep ravines extend southward through Units 2 and 3 into the Red River flood plain, where salt cedar (*Tamarix gallica*) is abundant.

Data were collected by two full-time field assistants, one of whom had trapped and banded doves in the area during the summer of 1972.

To learn whether wintering doves were holdovers from the summer or were immigrants from distant origins, we captured a sample of doves to determine the proportion wearing numbered metal leg bands which had been applied to 3,067 doves captured in the area during the preceding summer or leg bands applied in other states. Our own leg bands were affixed to the wintering doves we captured and released, in anticipation of their being recovered elsewhere should the doves belong to nesting populations in other states. Green, yellow, and silver plastic streamers (12) were affixed to one or both wings of winter-captured doves to reveal local movements and incidence of wintering doves remaining in the area in the nesting season of 1973. Each trapping location was identified by a characteristic wing-color combination to enable detection of movements over the study area.

Since we had no previous experience with winter trapping, we tested a system which had proved successful the previous summer (13). Modified Thompson wire traps (14) baited with proso millet were deployed in fields where doves concentrated; field personnel checked the traps two or three times daily to tag and release the captured birds. Doves were shot throughout the winter to recover leg bands, in case live trapping might prove fruitless, and to examine physical characteristics of the birds. Doves trapped or shot were identified as to age and sex on the basis of their plumage (15, 16). Necropsied birds were weighed, measured, and sexed by gonad examination. Their overall body condition was considered as an indication of the severe weather and difficult feeding conditions experienced. Crop contents were analyzed (17).

Beginning in July 1972, doves were censused several times weekly by road counts in all four units. The wintering period could be established by showing when the summer population declined in autumn, when the fall migration terminated, and when spring migration began. By restricting other studies to the interval between major changes in population density, the findings would apply strictly to wintering birds. At first doves were counted at four periods of the day, i.e., from 7 to 10 AM, 10 AM to 1 PM, 1 to 4 PM, and 4 to 7 PM. Because the 4 to 7 PM period consistently gave the highest counts, after 30 September the census was conducted only at that time of day. Counts were made while driving, at 25 miles/hr, over designated roads in each unit. Road censuses were also used to compare population densities and flock sizes in various parts of the area, to note kinds of habitat associated with various activities, and to observe movements of color-marked birds.

Doves were observed systematically at all

times of the day to describe and quantify behavior and activities, especially interactions with key environmental characteristics. Their responses to weather conditions were especially important; meteorological records for the study area were kept and further records were obtained from nearby government weather stations.

RESULTS

Distribution and density of population

Censuses for the total study area indicated that the summer population, which probably included immigrant immature doves as well as local doves, peaked during early August (Table 1) and then declined during the rest of the month. Road counts were not made from 27 August through 2 September, when the crew gathered and stored traps and checked hunting activity. In September, the census figures increased markedly through 16 September, then dropped abruptly to averages comparable to those of early July. The increase in numbers between 3 and 16 September probably resulted from a great influx of migrants. The rapid decline between 17 and 30 September occurred after a cold front and heavy rain swept through the region. Census figures through October remained low, not exceeding 4 birds per mile, until the final week when there was a substantial increase to 9.65 birds per mile in Unit 2. In the other three units the figures were 1.12 birds per mile or less. Doves in Unit 2 were gathering into large flocks that remained restricted to relatively small areas around key feeding locations. After 31 October road counts were abandoned for the remainder of the winter.

TABLE 1. *Number of mourning doves according to roadside counts, Jackson County, Oklahoma, 1972.*

	Weekly periods	Miles driven	Doves seen	Doves per mile
July	2 - 8	86	226	2.63
	9 - 15	177	855	4.83
	16 - 22	164	608	3.71
	23 - 29	118	573	4.86
30 -	Aug. 5	129	1051	8.15
Aug.	6 - 12	234	1322	5.65
	13 - 19	334	1457	4.36
	20 - 26	150	1043	6.95
Sept.	3 - 9	188	2742	14.58
	10 - 16	162	1904	11.75
	17 - 23	466	1744	3.74
	24 - 30	379	1091	2.87

During the main part of the winter, from 1 November through 31 January, most doves were grouped into a few large flocks at major feeding sites in Unit 2. Doves were rarely seen elsewhere in the study area except for a large concentration of birds at a haygrazer field in Unit 1. Until the end of December, 1972, doves were concentrated on three haygrazer fields, where they fed on waste grain, and on one cotton field, where they initially fed on weed seeds but eventually seemed to rely on trap bait. Counts at each location varied from 75 to 100 birds at the cotton field, and 100 to 150 at each of the haygrazer fields. We estimated that between 500 and 600 doves were in the area.

In early January, a flock disappeared from one of the haygrazer fields, another flock moved from a second haygrazer field to a nearby weed-pasture-timber complex, and two new flocks built up at haygrazer fields that previously had not been used. A sizeable number of doves in the original flocks had been color-marked by January and these birds showed strong fidelity to the location in which they were trapped. Few doves in the flock that disappeared showed up elsewhere. The newest flock, which originated after 1 January 1973, contained very few color-marked birds.

After a severe sleet and snow storm on 6 and 7 January 1973, which left a ground cover of 5 inches of ice and snow lasting through another week, doves congregated at trap sites, in cattle feed lots, in barns and sheds, and in shelterbelts and tumbleweed piles along fences. After most of the snow had melted, about 18 January, the estimated size of the total population had dropped to about 150 doves. They were still principally in Units 1 and 2, but flocks of 15 to 20 birds were seen at other locations in the study area and they seemed to move about considerably. Most of the doves were probably forced out of the area or killed by the storm.

The estimated number of birds remained at less than 100 until mid-April. Road counts, resumed in the four units in late March, made possible a study of buildup as the nesting population returned. The

dove-per-mile figure rose gradually from about 0.25 birds per mile or less in late March and early April to about 2.5 birds per mile in early May. The figure then ranged randomly between 2 to 5 birds per mile until 23 June at which time we terminated the census. The nesting population appeared to reach a plateau of numbers in the week of 6-12 May. Color-marked doves were seen extremely infrequently after 1 March.

Capture and marking

Trapping and the leg banding of 536 doves took place from 12 November 1972 through 1 February 1973. Of these, 336 were recaptured one or more times (Table 2). The trapping system used was acceptably productive, especially during times when bad weather appeared to impede feeding and doves became more attracted to the bait. Rate of capture varied inversely with changes in temperature (Fig. 1). Peaks of capture occurred from 7 to 15 December and during the first two weeks of January, each period coincident with the two major lows in temperature.

TABLE 2. *Number of doves recaptured according to numbers of times recaptured, Jackson County, Oklahoma, November 1972 - February 1973.*

Numbers of times recaptured	Number of doves in recapture category
1	96
2	59
3	28
4	13
5	8
6	7
7	4
8	1
9	4
10	1

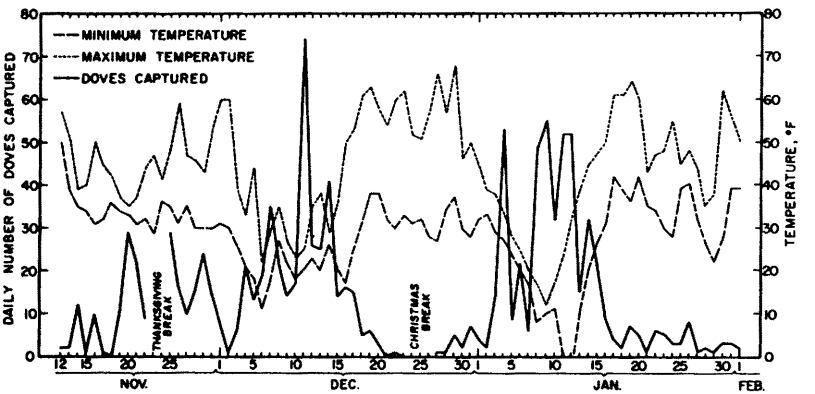

FIGURE 1. Comparison of daily capture rate of doves with minimum and maximum daily temperatures, Jackson County, Oklahoma, 12 November 1972 to 1 February 1973.

The 314 doves which we color-marked exhibited strong fidelity to their places of capture. When trapping began, it was apparent that doves were congregated into large flocks each of which remained in the vicinity of a feeding field and a nearby roost. Retrapping and observations on free-ranging doves disclosed that less than 10% of the marked or banded birds moved from one flock to another. Only two of the 3,067 doves banded in the summer of 1972 were recaptured during the winter study period. One dove was recovered on 22 January, the other on 26 February, well after the drastic population decline following the ice storm of 6-7 January. It is possible that these two doves were not members of the overwintering group, but were early members of the 1973 nesting population returning from a more southerly wintering area.

Behavior and activities

In autumn and again at the end of winter, patterns of daily activities changed

markedly. Highlights of characteristic behavioral patterns are presented by months to illustrate gross differences.

September. During September doves began forming large roosting flocks that scattered over the plowed wheat fields to feed in early morning and late evening (7-9 AM and 4-6 PM). During midday they roosted close by ponds, usually sitting on the ground beneath mesquite trees or in the lower parts of the trees less than 4 ft above ground. After the evening feeding period, all gathered into huge flocks that moved southward toward the heads of large ravines running south into the Red River bottoms. The doves flew south along these ravines, stopping at dammed stock ponds to drink, and then flew on to the river bottoms to roost in hackberry, chittamwood, and soapberry (*Sapindus drummondii*) trees. When dispersing from roosts to feeding areas in the morning, however, doves scattered northward in small groups or individually rather than as large flocks moving along the major ravines.

By 20 September, doves were rarely seen flying during midday. Birds remained on the ground in wheat fields or mesquite resting areas, moving in short, low flights rather than passing long distances at high altitudes as they did during the June-August period. By 25 September feeding shifted noticeably from the plowed wheat fields to harvested haygrazer fields and to cotton fields where pigweed (*Amaranthus* sp.) flourished.

October. By 1 October, doves were scarce in area Units 1 and 4, and during the week of 8-14 October their numbers decreased markedly in Units 2 and 3. Doves remaining in the area were feeding predominantly in haygrazer although considerable wheat and weed seeds were still being eaten. Until the population decline of 8-14 October, doves in Units 2 and 3 maintained the daily pattern of roosting at night in the Red River bottoms and scattering out to feed and rest over Units 2 and 3 in the day time. After 1 October doves no longer concentrated around ponds while day resting, but they still used mesquite thickets, where they perched on lower branches or on the ground. The concentrated evening flights down ravines to night roosts along the Red River ended by 14 October when doves began roosting in localities near feeding areas. By 22-28 October feeding was restricted largely to haygrazer.

No specific pattern of movement was evident between roosts and feeding areas after 15 October. Doves appeared to move randomly in small flocks between mesquite and grain fields until 28 October.

November. By 1 November, doves were grouped mainly into distinct flocks based at specific haygrazer and cotton fields and specific roost areas near the feeding fields. Daily movements were associated with two principal feeding periods, in the morning from about 8 to 10 AM and in the evening from 4 to 6 PM. Between these periods, doves either continued to feed in their chosen field or went to their resting areas. Frequent movements between resting and feeding areas persisted through the day as birds went back and forth between them. Each feeding area had a principal resting area and separate night roost. Doves spent days in mesquite thickets, soapberry groves, or stands of hackberry and chittamwood trees. They persisted in sitting on the ground or in the lowest tree limbs less than 6 ft above ground. Night roosts were in cotton fields or, in one case, a grazed haygrazer field that had grown up in weeds. At night roosts, doves sat on the ground. At the end of the evening feeding period, when doves were concentrated in the haygrazer fields, the birds rose in great flocks high in the sky then dropped into the night roosts. Some birds in two of the flocks went to nearby ponds to drink before going to roost.

Light snows fell on 21 and on 29 November. At such times, and during periods of colder temperature, doves fed actively throughout the day. At night they still roosted on the ground. If flushed from a feeding field, they flew to nearby trees or into cotton fields where they sat for 5 to 15 min before returning to feed. They would not leave the area.

December. Behavior was similar to that of November. Intensive observation at dusk revealed greater numbers of doves going to ponds for a drink than we had realized. Two ponds in particular were used regularly by many birds from the two major flocks observed. Feeding tended to be heaviest about 8 to 10 AM and 4 to 6 PM. Some feeding persisted throughout the day, and

this continuous feeding intensified on cold days. Feeding activity lessened considerably during a warm spell from 17 to 23 December.

An owner put several cattle into one haygrazer field, and they soon trampled and consumed the remaining feed. Doves using the field then concentrated more in their night-roost area, where they fed on weeds and the remains of another harvested haygrazer field. During the day they sat in large numbers on piles of brush and tree limbs in an area where vegetation had been cleared and piled. Doves became sedentary, spending both night and day in the area; they moved no more than 25-30 yards when flushed. At such times they flew close to the ground from one group of trees or bushes to another. Their flight distance became extremely short, compared to earlier times, and people could approach to within 15 to 20 yards before they moved. During cold, windy days, doves often sat on the ground in depressions or hollows.

January. Until 6 January behavior remained similar to that of December, despite light snow on 2 and 3 December. On 6 January a blizzard deposited a mass of sleet over the area. On 7 January a snowfall of 4 to 5 inches covered the ice, and prevented doves from feeding in the customary manner. The low temperature persisted through 11 January, after which the snow and ice melted throughout another 3 to 4 days. During the 6 days of heavy snow and ice cover, dove behavior changed drastically. Some doves fed continuously through the daylight hours in cattle feed lots and at trap sites. They moved little and rested periodically on the ground on the south side of any structure providing a break against the north wind.

At night they stayed near feeding areas, roosting in sheds and barns, brush piles and dead tree tops in cleared fields, shelterbelts, and masses of tumbleweeds piled up on east-west fences. Great numbers of doves were found dead at these roosting places. They apparently died of starvation, judging from their emaciated condition. We could not determine what enabled some doves to range out in successful search of food, whereas others could not or would not leave the shelters. Rows of dove carcasses lined the ground along the south edge of the shelterbelts and tumbleweed piles. They may simply have been frozen there while trying to escape the sleet and strong winds on 6 January. Doves died in farm buildings also, and these birds seemed definitely to have starved rather than having succumbed to direct effects of the weather.

Doves encountered in feed lots or in buildings were very docile and easily approached. Some were picked up and handled by field personnel. Doves seemed reluctant to stay on the snow. They frequently sat on top of traps, cotton plants, bushes, or any dry structure. Several had large masses of ice on their feet and underplumage. By 14 January the snow and ice had melted enough to expose much bare ground. Doves in the remaining, markedly reduced population returned quickly to pre-blizzard behavior and maintained it through the remainder of January.

Total mortality was extremely difficult to estimate because so many doves died in hard-to-reach places where roads were impassable, in cover where predators and rodents destroyed many carcasses, and in such irregular distribution over the area that sufficient samples could not be obtained quickly enough to calculate the number of deaths in the entire study area.

February. The dove population was so low that trapping became unproductive and traps were taken up. The problem was aggravated by increased killings of trapped doves by shrikes (*Lanius ludovicianus*), which entered the traps. Because doves were so scarce around Eldorado, field personnel sought birds elsewhere and found a heavy concentration near Mangum, 40 miles north of the study area. Habitat in the Mangum area was similar to parts of the Eldorado study area; it contained mixed areas of pasture, haygrazer, and wheat, but had considerably more maize, much of which was still uncut. Shelterbelts and farm sheds provided roosting areas. The gross behavior of doves in the Mangum area appeared similar to that of doves in the study area in that flocks were based on fixed, companion roost-feed locations which they did not leave.

Doves also experienced heavy mortality during the January storm in the Mangum vicinity, with many dying in barns and sheds. Mr. Wes Webb, Wildlife Conserva-

tion Department Game Ranger for Greer County, estimated that 4,000 doves died there as a result of the storm.

General behavior

The greatly diminished dove population changed locations of use after January. The flock that fed and roosted in the cotton field vanished when trapping ended, which implied that the millet bait around the traps had held them there. Another flock using a small haygrazer field also disappeared. Two new flocks appeared in new locations. Doves in the new flocks had very few color-marks of the vanished flocks; they apparently came from another area. The new flocks settled at previously unused haygrazer fields. The change suggested that food had been exhausted in the original locations.

A few small flocks of 15 to 20 doves, apparently not attached to fixed locations, were seen at various places, feeding in cattle-feed lots or haygrazer fields and roosting in nearby mesquite thickets.

Between 1 November 1972 and 28 February 1973, 124 doves were necropsied. The ten most abundant foods, by weight, in their crops are summarized in Table 3. The preponderance of haygrazer is noteworthy. Samples taken from crops before 1 November showed a higher proportion of wheat in relation to other ingested foods. Crop contents sampled after 28 February showed a higher proportion of weed seeds.

TABLE 3. *Ten foods most commonly ingested by mourning doves in Jackson County, Oklahoma, 1 November 1972 to 28 February 1973.*

Rank	Species ingested	Total amount (grams)
1	*Sorghum vulgare* x *Sorghum sudanense*	256.4
2	*Panicum miliaceum*	52.4
3	*Triticum aestivum*	22.4
4	*Amaranthus* sp.	20.5
5	*Helianthus petiolaris*	11.7
6	*Bumelia lanuginosa*	4.2
7	*Argemone* sp.	2.2
8	*Panicum* sp.	1.8
9	*Hordeum vulgare*	1.4
10	*Avena* sp.	0.7

Physical characteristics

Sex ratios of doves examined before, during, and after winter (November-January) are shown in Table 4. The sexes of necropsied adult doves were first recorded in the field on the basis of plumage; the initial judgement was then checked later by examining gonads in the formalin-fixed carcasses, which also identified the sex of immature birds. Necropsies revealed that judging sex by plumage characteristics was 99.5% accurate and, hence, verified the sex identification based on the plumage of live-trapped doves. Of 460 necropsied doves, only 12 females and seven males were incorrectly identified in the field; only two males and one female could not be sexed by plumage and were listed as unknowns until necropsied.

TABLE 4. *Sex ratios of mourning doves live-trapped and released or collected and necropsied, September 1972 through March 1973, Jackson County, Oklahoma.*

Month	Number of necropsied doves				Number of doves trapped and released		Total number of doves	
	Immature		Adult		Adult only			
	♂	♀	♂	♀	♂	♀	♂	♀
Sept.	23	22	23	21			46	43
Oct.	16	13	14	14			30	27
Nov.	14	6	10	4	47	37	71	47
Dec.	2	4	17	1	87	57	106	62
Jan.	3	4	17	7	93	29	113	40
Feb.	3	2	24	10			27	12
Mar.	0	0	24	13			24	13
Totals	61	51	129	70	227	123	417	244

During September and October, sex ratios were comparable in both adults and immatures. In November, males predominated in both age classes in necropsied birds and in trapped birds. Immature birds became numerically insignificant after November, too scarce to provide a meaningful comparison, but among necropsied adults males predominated in a ratio of approximately 2 to 1 over females. In December and January, males also significantly outnumbered females among trapped doves.

Doves still wearing plumage characteristic of immature birds were captured throughout the entire trapping period, which would suggest that some birds were hatched in late fall or early winter. Among 226 immature doves examined between 12 November 1972 and 26 January 1973, 123 of them apparently were hatched between 1 October and 30 November (Table 5).

Average weights of adult birds collected between 1 September 1972 and 30 April 1973 are listed in Table 6. The weight increases occurring through December probably reflect the transition of immature birds into adult size range. The sharp decline in January resulted from the effect of the blizzard occurring on 6-7 January and its aftermath of snow cover and low temperature. Average weights increased in February to ranges approximating those of 1972.

TABLE 5. *Tentative estimation of hatching periods of immature mourning doves captured in 1972-73 winter, Jackson County, Oklahoma.*

Estimated hatching period	Nov. 12 - Nov. 18	Nov. 19 - Nov. 25	Nov. 26 - Dec. 1	Dec. 2 - Dec. 8	Dec. 9 - Dec. 15	Dec. 16 - Dec. 22	Dec. 23 - Dec. 29	Dec. 30 - Jan. 5	Jan. 6 - Jan. 12	Jan. 13 - Jan. 19	Jan. 20 - Jan. 26	Number of doves in hatching period
Jul. 16-Jul. 31	1											1
Aug. 1-Aug. 15	2			1								3
Aug. 16-Aug. 31	1	3	4	1	2							11
Sep. 1-Sep. 15	3	12	7	2	6			1				31
Sep. 16-Sep. 30	5	18	11	6	13	1		2	1			57
Oct. 1-Oct. 15	6	14	8	15	11	4	1	3				62
Oct. 16-Oct. 31	1	5	6	11	4	7		5	3			42
Nov. 1-Nov. 15			1	2	2	1	1	2	6		2	17
Nov. 16-Nov. 30									1		1	2
Totals	19	52	37	38	38	13	2	13	11		3	226

TABLE 6. *Mean weights (g) of adult doves collected, September 1972 through April 1973, Jackson County, Oklahoma.*

	1972				1973			
	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Male								
Number	17	14	10	17	42	23	25	59
Average weight	118.2	117.9	126.4	127.2	94.6	127.0	126.2	118.3
Female								
Number	15	14	4	1	23	10	13	12
Average weight	108.9	109.8	115.0	131.7	89.9	114.6	115.0	105.5

DISCUSSION

Observations made in the winter of 1972-1973 were intended principally to gain insight for preparing more exact goals and methods for continuing study in future winters. Nevertheless, certain phenomena were sufficiently informative to deserve reporting, particularly to direct attention to the presence of wintering doves in Oklahoma and to encourage interested persons to communicate information about overwintering doves to the Oklahoma Cooperative Wildlife Research Unit.

Especially noteworthy was the fact that only two doves out of 3,067 banded in the summer of 1972 were among the 796 doves captured or collected during the ensuing winter. This seems to be strong evidence that wintering doves are not holdovers from the summer population. Failure to capture doves banded elsewhere, however, prevented us from learning the origins of wintering doves. To date, none of our color-marked doves has been reported from nesting areas in other states.

The permanence of flocks on roosting and feeding sites that are near each other indicates a strong need for certain conditions that are found only in restricted locations. Close proximity between roost sites and feeding sites and restricted movement within the combined area of such locations suggest a system for conserving energy. Seemingly attractive feeding areas were unused by doves, perhaps because their preferred roosting or resting areas were too far away. We need to establish an efficient method for evaluating mass mortality resulting from severe storms. The extent of mortality resulting directly from the storm should be distinguished quantitatively from numbers of deaths among birds which survived the initial effect of the storm but subsequently failed to find food and succumbed to malnutrition.

Field work scheduled for the winter of 1973-74 will concentrate on obtaining greater detail on the phenomena emphasized here.

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