

WINTER MOVEMENT AND HABITAT USE BY

HARRIS' SPARROW

Zonotrichia querula (Nuttall)

By

DONALD DEAN BRIDGWATER

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Thesis Approved:

F. M. Baumgartner

Thesis Adviser

Roy W. Jones

Don Schwyn

J. H. Boyer

Dean of the Graduate School

570135

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INTRODUCTION

The winter movements and habitat requirements of Harris' sparrow, Zonotrichia querula (Nuttall), in its winter range have been the subjects of little scientific investigation. The relatively restricted winter range was mapped and described (Swank and Stevens, 1927) as principally south from southeastern Nebraska to central Texas, roughly between longitudes 94° and 98°. The area is approximately 200 miles wide by 900 miles long and the center of population is probably located in north-central Oklahoma.

Park (1936), Harkins (1937), and Steelman and Herde (1937) made a consecutive banding study near Stillwater, Oklahoma, during the winters of 1934 to 1937. Their papers are concerned chiefly with plumage study and yield little data on the winter activity of Harris' sparrow. Baumgartner (unpub. ms.) has made an extensive study based upon thirteen years continuous banding at a single banding station near Stillwater, Oklahoma, from 1948 to 1960.

The present paper reports a study made during the winter of 1961-1962. Five trapping stations were established within a one mile radius north of Stillwater, Oklahoma. Two hundred forty-seven Harris' sparrows were banded, color-marked according to trap station, and some birds were marked for individual recognition. Field observations were made throughout the study. Answers to the following questions were sought. What is

the extent of the local winter range utilized by Harris' sparrow? How stable in time and place are these birds? Is there winter wandering? What conditions effect winter movement? What type of habitat is sought out by the bird?

The literature reveals few winter studies of this type for passerine species. It is hoped the techniques used and the data found will be of value in the study of similar species, as well as a contribution to the life history of Harris' sparrow.

METHODS

Traps and Trapping Technique

Three types of traps were utilized, all operating upon the principle of a funnel entrance at ground level. A modified government sparrow trap was used at four stations. A three-leaved-clover trap, and a six by six foot house trap were used at a fifth station. All three types are described by Lincoln (1947).

Harris' sparrow being primarily a ground feeder, the traps were placed on the ground close to the protection of a brushy area, shrubs, or tangles of greenbriar, yet enough in the open to provide clear vision in all directions.

The traps were baited with grain sorghum scattered in and around the trap. They were visited twice each day, once just before 12:00 noon and again just before sunset. In cold or wet weather, three to four regularly spaced visits were made to prevent any unnecessary exposure of the trapped birds.

On November 4, 1961, trapping stations A, E, and F, were established. At each station two traps were located ten to twenty yards apart. On January 10, 1962, two traps were taken from stations E and F, and used to establish station H¹ (Harned property), and H² (Hazen property). Five stations were in operation from January to May, 1962. They were located within a one mile radius with a minimum distance of one-fourth mile and a maximum distance of one mile.

Banding and Color-marking

The birds were banded with standard, split-ring, aluminum bands, size 1A, issued by the Federal Fish and Wildlife Service. The methods of handling the birds are those described by Lincoln (1947).

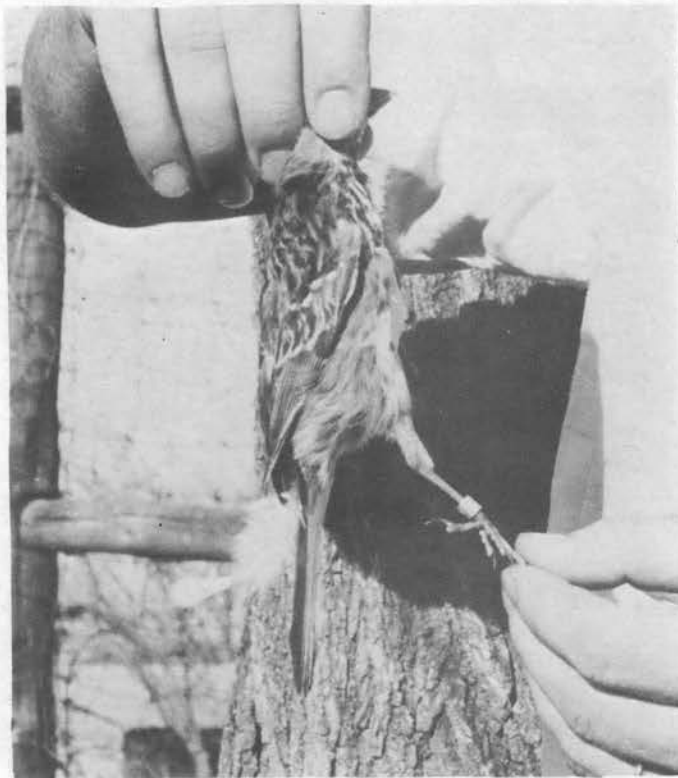


Figure 1. A Banded and Marked Bird.

Color-marking was done (Figure 1) by cementing a colored feather beneath the upper tail coverts along the shaft of a main tail feather as described by Baumgartner (1938) and Leopold and Anderson (1938).

Each station was assigned a particular color, and the birds were color-marked correspondingly as follows: station A - white; station F - red; station H² and E - green; and station H¹ - lilac. When the birds were apparently settled for the winter, some individual color-marking

was done. Using additional colors of blue, orange, and yellow, a limited number of color combinations were used with two feathers attached to each bird. It was possible to recognize some individuals without special marking due to characteristic size, shape, or color of the original marker. Twenty-five birds were individually marked.

Field Observation

Field observations were made from October 30, 1961, until May 10, 1962, using 7 x 35 power binoculars. The entire study area was covered at least twice each week. The daily trap visits contributed additional observation data.

Field maps of the area were used to plot numbers, location, and distribution of the birds. The area surrounding the general study area was covered regularly in an attempt to locate marked birds. Aid, in the location of marked birds, was received by publicity of the research in two locally distributed daily newspapers.

Sexing and Aging

No attempt was made to sex the birds since there are no known external differences in the sexes, (no birds were collected for dissection and sexing is guesswork otherwise).

The immature, first year birds are distinguishable from the adults due to plumage coloration. Three types of plumage were exhibited; the immature, winter adult, and spring full breeding plumage. The birds were divided into immature and adult forms using the characteristics described by Baumgartner (unpub. ms.).

DESCRIPTION OF THE STUDY AREA

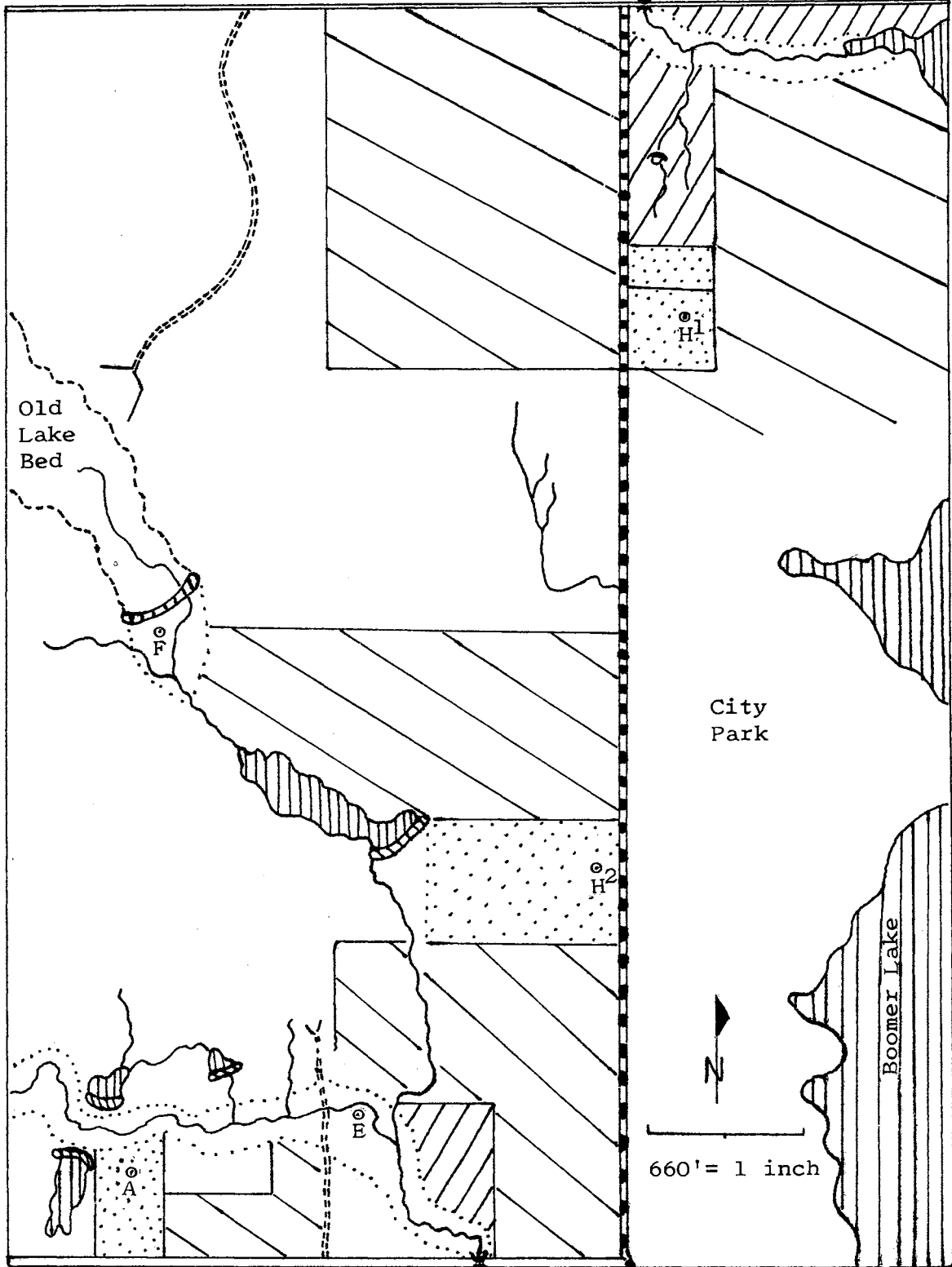
General Description

The study area consisted of approximately 480 acres situated on the north-northwest edge of Stillwater, Oklahoma, and included a portion of its suburban area. This locality was originally tallgrass prairie bisected with small, timbered ravines, and intermittent streams. Due to cultivation, real estate subdivision and the establishment of a reservoir, the area was divided into small acreages of grassland, cultivated fields and housing developments.

The north-south boundaries were arbitrarily selected on roads because there was no natural break in the habitat. A small wooded ravine leaves the study area at either end providing the birds with natural travelways. Eastward, an artificial reservoir (Boomer Lake) and westward an expanse of tallgrass prairie form natural boundaries which no doubt restricted lateral movement. The area is one mile long north to south and three-fourths mile wide, east to west. A state highway bisected the area into an eastern 160 acres and a western 320 acres. Figure 2 reveals the major characteristics of the area.

Community Types

The area is divided into the following community types (Figure 2) on the basis of the vegetation and land use practices: (1) Tallgrass prairie; (2) Residential-Subdivision; (3) Timbered ravine; (4) Disturbed-



LEGEND:

Residential-Subdivision



Disturbed-Cultivation



Lawn-Cultured



Tallgrass prairie



Timbered ravine



Figure 2. A map of the general study area showing the distribution of community types and the location of the five trap stations.

Cultivation; and (5) Lawn-Cultured. A description of each type, including the dominant plants and features is given below.

Tallgrass prairie - The open grassland areas bordering Boomer Lake and the timbered ravines were tallgrass prairie. An old artificial lake bed in the process of succession toward grassland climax is included. The area was dominated by big and little bluestem grasses (Andropogon gerardi and A. scoparius), Indiangrass (Sorghastrum nutans), and switchgrass (Panicum virgatum). There was a sprinkling of shrubs present in the form of thickets, including sumac (Rhus spp), wild plum (Prunus spp), and coralberry (Symphoricarpos orbiculatus).

Residential-Subdivision - The natural habitat was being rapidly replaced by housing developments. The area was bisected by newly constructed streets and staked-out lots, with the presence of a few old residences, a few well developed lawns, shrubs, trees and many open grass or weed dominated areas.

Timbered ravine - Two wooded ravines (containing intermittent streams) with a great amount of upper and lower story cover were included in this type. The dominant trees were cottonwood (Populus deltoides), elm (Ulmus spp), hackberry (Celtis spp), and red cedar (Juniperus virginiana). Willow (Salix spp), red bud (Cercis canadensis), and roughleaf dogwood (Cornus drummondii) were present in small numbers. Large brushy tangles of poison ivy (Rhus spp), greenbriar (Smilax spp), and blackberry (Rubus spp) were present. The limited ground cover was of various forbs and grasses.

Disturbed-Cultivation - The cultivated sections included all disturbed areas and old fields in various stages of secondary succession.

No portions had been recently cultivated. Two abandoned fields and an old farmstead site were included in this type. The dominant vegetation was forbs and grasses, including sunflower (Helianthus spp), ragweed (Ambrosia spp), pigweed (Amaranthus spp), annual broomweed (Gutierrezia drancunculoides), Johnson grass (Sorghum halpense), three awn grass (Aristida spp), and burmuda grass (Cynodon dactylon).

Lawn-Cultured - The lawn-cultured division included three large, cultured or semi-cultured acreages with extensive lawns, including well developed plantings of ornamental shrubs and trees. There were some areas of managed vegetation.

The estimated composition of the community types were as follows: Tallgrass prairie, 50 percent; Residential-Subdivision, 35 percent; Timbered ravine, 5 percent; Lawn-Cultured, 5 percent; Disturbed-Cultivation, 5 percent.

Station A

Station A was located in the southwest corner of the study area and included a portion of timbered ravine and lawn-cultured community. It was surrounded on three sides by tallgrass prairie. A timbered ravine led east behind a group of residences, several brushpiles, vinetangles and a dense stand of red cedar (Juniperus virginiana) were present. Two small farm ponds were present. Station A had been a bird sanctuary for several years and is the site where the thirteen year banding study of Harris' sparrow mentioned earlier was made (Baumgartner, unpub. ms.). Band returns mentioned later applied to birds that were originally banded here.

Station E

Station E included the eastern one-half of the timbered ravine in area A. The trap was located about 1,000 feet downstream from the station A traps at a point where a north branching tributary joined the timbered ravine. The stream skirted an abandoned field and continued south passing under the road which formed the southern boundary of the study area. The major community types present were the timbered ravine and disturbed-cultivation. Midway between stations A and E, the cover had been opened to make a cow lot and the resulting brush had been piled in a long stack along a deep ditch. The resulting brush pile and open area were of major importance to the local group of Harris' sparrows (Figure 6). Tangles of greenbriar and blackberry were predominant.

Station F

Station F was located along the north tributary of station E, about one-half mile north. The trap was in a small patch of timber below an old lake dam and sheltered from the north by the dam. Laterally, the area was restricted by tallgrass prairie bordering the timber. A pond cut across the southern edge of the area. Contractors had nearly destroyed the trees and undercover along the ravine shortly after it left the immediate vicinity of station F until it entered station E area. A small patch of woods existed below the old pond dam. The entire area was damp and boggy all winter.

Station H¹

Station H¹, located in the northeast section, held the largest population of Harris' sparrows throughout the winter. Immediately surrounding the trap was the lawn-cultured type. North of the trap was a farmstead site and a small irrigation pond. The area had grown predominantly to grasses and a dense stand of sunflowers, ragweed, pigweed, a thick row of red cedar, and a small grove of honey locust (Gleditsia spp). At the north edge, a wooded ravine ran east into an arm of Boomer Lake (see Figure 3). On either side of the ravine were large disturbed areas overgrown with various seed producing forbs. Two wooded ravines led north, providing convenient travelways for birds. Mr. and Mrs. Owen Harned, who own the land surrounding the trap site, maintain a heavy feeding program for birds.

Station H²

Station H², classified as a lawn-cultured type, was bordered on all sides by new housing developments. Mr. and Mrs. Leslie Hazen, who own the property, have developed large plantings of trees and shrubs of numerous species including many large pines and cedars unique to the area. Several small irrigation ponds and considerable open lawn completed this habitat.

RESULTS

General Trapping Data

Daily field trips were begun during the last week of October, 1961. On November 3, 1961, three Harris' sparrows were observed in area E and traps were put into operation on November 6, 1961.

A total of 247 birds were banded and marked (Table I). Of these, 231 were newly banded and 16 were returns. Stations E and H² were combined because their birds were common aggregations.

TABLE I

A SUMMARY OF HARRIS' SPARROWS BANDED AND MARKED
DURING THE STUDY

Area	Newly Banded	Returns	Im- mature	Adult	Total Birds	Percent	
						Adult	Immature
A - White	36	2	28	10	38	26	74
F - Red	24	2	21	5	26	19	81
E + H ² - Green	39	12	25	26	51	49	51
H ¹ - Lilac	132	0	94	38	132	29	71
Total	231	16	168	79	247	32	68

Area H¹ (Table I) contained an unusually large population of Harris' sparrows. Several marked birds were found here in late December, consequently a trap was set on January 10, 1962, and operated throughout the study. Heavy artificial feeding coupled with several

midwinter storms and seemingly ideal habitat provided large catches and made the monthly trap records indicated by Table II, somewhat atypical.

TABLE II
NUMBERS OF BIRDS TRAPPED, INCLUDING AGE
COMPOSITION BY PERCENTAGE

Month	Returns	New Adults	Total Adults	Im- mature	Total Birds	Percent	
						Adult	Immature
November	3	4	7	26	33	21	79
December	8	4	12	17	29	41	59
January	2	6	8	50	58	14	86
February	3	25	28	43	71	39	61
March	0	20	20	21	41	48	52
April	0	4	4	9	13	31	69
May	0	0	0	2	2	0	100
Total	16	63	79	168	247	32*	68*

*Average percent for 7 months

Eliminating the data from station H¹, the largest number of birds trapped (33) for the first time was in November. In December, the number dropped to 29, and fell in January to 12 birds. In February, the number rose to 17 and then gradually declined through March, April, and May with 12, 10, and 2 new birds, respectively.

An analysis of weekly field counts in each area is given in Table III. In the table, each month is divided arbitrarily into four periods which are equivalent to one week. Eighty counts were made and the average figures are given in the table. Since the counts reflect the total Harris' sparrow population present in the area it is probable that a truer picture of monthly population changes is given in Table III. The data from Tables I and II agree with Table III closely

except that field census shows more birds present during March than in April, while trap records show the reverse.

TABLE III
HARRIS' SPARROW POPULATIONS BY WEEKLY COUNTS

Period	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
I	9	38	25	25	20	20	6
II	110	31	21	21	20	27	0
III	117	28	23	20	31	17	0
IV	34	27	23	20	34	9	0
Average	67.5	32	23	21.5	26.2	18.2	6

The bulk of the migrants arrived during the second and third weeks of November and then declined in number as they spread in search of permanent winter habitat or migrated further south, during December. The population was quite stable during January, February, and the first half of March. During the last half of March and the first two weeks of April a slight increase in numbers suggests that a small spring movement was occurring. The movement was less conspicuous than the fall movement. During the last week of April the population fell sharply and by May only a few scattered individuals remained. The last date in 1962 on which a bird was observed was May 8. The heavy wave of fall migration began in November, with weeks two and three highest. The population then declined to a low stable number through January, February, and March. A small increase in late March marked the weak spring

migration, continuing until the last birds left in early May. Park (1935), Harkins (1936), and Baumgartner (unpub. ms.) found the same general population trends in wintering Harris' sparrows.

Age Composition

Each bird trapped was classified as immature or adult on the basis of plumage coloration. Of the 247 birds handled, 68 percent were immature first year birds and 32 percent were adults. This is an approximate 1:2 ratio. It would be expected that the young to adult proportion should be about 2:1 initially, since there are few natural enemies and the number of eggs laid is four, with one brood each year (Baumgartner, unpub. ms.). Certainly, one years figures are not sufficient to make positive conclusions. Eliminating November and May figures due to insufficient numbers trapped, the trend was from a 3:1 ratio of immature to adult birds for November, December, and January to a 1:1 ratio in February and March. The latter ratio may be due to mortality among the young birds or to the fact that during periods of colder weather in late winter a higher proportion of adult birds visited the traps than during mild weather.

Return Birds

Sixteen return birds were trapped throughout the study. They were all originally banded by Dr. A. M. Baumgartner at her banding station north of Stillwater, Oklahoma. The station has been maintained since 1948 and is included within the present study area as station A. The returns are listed in Tables I and II by station area and the month in which they were trapped.

Table IV contains the history and activity data of the 16 return birds. Two returns, 885 and 089 repeated at the original station A where they were first banded and never visited other areas so far as is known. Four other birds (873, 461, 023, and 090) returned to station E first and later were trapped at station A, the original banding station. Ten returns, trapped at E and H² were never taken at the original station A. With three exceptions, all 16 birds were trapped initially during periods of extreme cold or snow cover.

TABLE IV

WINTER MOVEMENT AND HISTORY OF 16 RETURN HARRIS' SPARROWS

Band No.	First Trapped Date	Area	Times Trapped					Total	Age	Original Banding
			A	E	H ²	H ¹	F			
54-121465	Nov. 14, 1961	F					7	R-4	Feb. 11, 1958 Im.*	
55-156869	Nov. 18, 1961	F					4	R-2	Jan. 3, 1960 Im.	
58-107089	Nov. 17, 1961	A	4				4	R-1		
54-121590	Dec. 6, 1961	E		5	1		6	R-3	Jan. 12, 1959 Ad.**	
55-156873	Dec. 7, 1961	E	1	4			5	R-2	Jan. 5, 1960 Ad.	
54-121461	Dec. 10, 1961	E	1	4	3		8	R-4	Feb. 11, 1958 Im.	
53-199479	Dec. 11, 1961	E		2	4		6	R-5	Mar. 8, 1957 Ad.	
58-107023	Dec. 11, 1961	E	2	4	2		8	R-2	Mar. 25, 1960	
55-156880	Dec. 17, 1961	E		3	1		4	R-2	Jan. 7, 1960	
58-107090	Dec. 19, 1961	E	1	3	3		7	R-1	Feb. 8, 1961 Im.	
58-107097	Dec. 20, 1961	E		3			3	R-1	Feb. 8, 1961 Im.	
54-121475	Jan. 5, 1962	E		2	4		6	R-4	Feb. 11, 1958 Im.	
54-121501	Jan. 8, 1962	E		4	5		9	R-4	Mar. 17, 1958 Im.	
53-199446	Feb. 1, 1962	H ²			1		1	R-5	Jan. 17, 1957 Im.	
58-107086	Feb. 6, 1962	H ²		1	2		3	R-1		
55-156885	Feb. 16, 1962	A	2				2	R-1		

* Immature; ** Adult

All returns did not repeat at the original banding station but returned to the same general area and remained in the general vicinity of the original trap site. Sixty-two percent (10), returns "skipped" station A and 38 percent (6), repeated one or more times at station A. The

skipping pattern has been recorded commonly among returns by Baumgartner (unpub. ms.) but she had no information on the bird's activity during that year. Evidently, many "skip" birds actually return to the same general winter area as residents but are not recaptured and consequently are considered absent. Only 38 percent of the returns repeated at the original station A whereas 62 percent would not have been discovered had it not been for additional trap stations.

Winter Habitat of Harris' Sparrow

Nice (1929) found Harris' sparrow to be a bird of the underbrush, frequenting the shrubbery along creeks or edges of wooded area, especially vine covered trees. Swenk and Stevens (1929) noted that Harris' sparrows frequented brushy places, thickets, and stream edge. They found brush-heaps a favorite resort. Baumgartner (unpub. ms.) found them to be restricted to the brushy and weedy fringes of wooded areas and hedgerows.

The two centers of population were located in timbered ravines. One located north of station H¹ and the other running through stations A and E (Figure 2). The birds ranged up and down the wooded area daily, frequenting brushpiles, vine-covered trees, and thickets. Often they would gather in the top of particular trees in the area and sing. Associated with the wooded habitat were areas of the disturbed-cultivation type. The birds ranged into weed patches eating seeds of forbs such as sunflower and pigweed. They were found as daily visitors in the lawn-cultured type of stations H¹ and H², eating upon the expanses of lawn or moving about in the shrubbery. The birds were never found in the tallgrass prairie and were rarely seen in the residential-

subdivision type except when moving from one wooded area to another. An exception occurred during a period of severe weather when several birds were observed eating in back-yard feeders in the residential area.



Figure 3. Typical Harris' Sparrow Habitat. A disturbed area of weeds and brush associated with a timbered ravine seen in the background.

Figure 3, illustrates a portion of station H¹, typical of the disturbed-cultivation type associated with a timbered ravine, which held the largest concentration of birds. Note the brushpile at the head of the small pond near the center of the picture. The brushpile was a congregation point for resting and sunning birds, often occupied by 30 to 40 Harris' sparrows at one time. Also note the small red cedars just to the left of the pond. Figure 3, represents ideal Harris' sparrow habitat.

Each area of population concentration had a central feature or

landmark where birds could usually be found regardless of the weather or time of day. More often than not the entire population would be present. Figures 4 and 5 (page 20) are photographs of two examples.

Harris' sparrows in the study were definitely concentrated along timbered ravines with an open, brushy edge. Large patches of seed producing forbs were associated with the wooded areas. The birds utilized certain favorite perches, including shrubs, thickets, brush-piles and vine-covered trees extensively. The open prairie and residential areas were rarely visited.

Winter Movement

In considering winter movements and social behavior of Harris' sparrow, the terms "territory" and "flock" are not applicable. Territory exists only when a species defends a given area as its own (Kendeigh, 1961). Harris' sparrows did not exhibit this behavior in any instance. The term flock is not applicable in a strict sense to the occupants of a given area because the birds within a given area did not consist of the same individuals from one day to the next. Each group of birds within a given area consisted of a loose aggregation of individuals showing little group tenacity.

In this paper, the area in which a bird established its daily routine during the winter months is termed the local winter range and the birds loosely associated in these areas are referred to as groups.

My observations, in agreement with the findings of other investigators, suggest that the period of winter residence by Harris' sparrow may be divided generally into three periods: (1) a fall period of relatively mild weather in which the birds arrive and shift about as they seek permanent winter habitat; (2) a mid-winter stable period in which the birds establish their local winter range; (3) a spring period of



Figure 4. A Vine-covered Tree Near Station F. This tree served as a headquarters point for Harris' sparrows in the area



Figure 5. A Brush-filled Ditch in Areas A - E. This site was the central headquarters for birds in these areas.

changeable weather during which the birds begin to show restlessness and premigratory excitement.

No set dates are suggested for these three divisions. No doubt the onset and duration of a given period from year to year is dependent upon numerous factors, including chiefly weather conditions and habitat changes. The dates mentioned in the following data would not necessarily apply in another given year.

The linear distance between stations varied from 1,000 to 4,356 feet. Figure 6, illustrates the distance relationships between the five trap stations.

The Fall Period - The fall period extending from the date of the first fall arrivals to January 9, 1962, when the first severe snow and freezing weather of the season occurred, represented a time of movement and adjustment to changing environmental conditions. The first birds were seen on November 3, 1961, near station B and the first birds were captured at station F on November 9, 1961. Twenty-three birds were banded and marked at station F throughout the fall period. During the first two weeks of November, census numbers were high in the area, with several birds usually found in a brushy, weed-patch in the shelter of an old lake dam. Census figures declined weekly until December 4, 1961, when only 4 birds were found. From December 1 to 24, two new birds were marked. After December 24, no birds were found. Station F was completely deserted and remained unoccupied for the remainder of the study period with the following exceptions; a new bird, banded January 11, 1962, during a period of inclement weather immediately moved out of the area; number 61-168028, which had been originally banded at station F, returned on January 6, and remained all day frequenting landmarks which the group had used previously; a return bird, number 54-121465 repeated February 12, then

disappeared; finally, a white plumed bird was found at station F on March 18 and was identified as a recently marked spring migrant at station A.

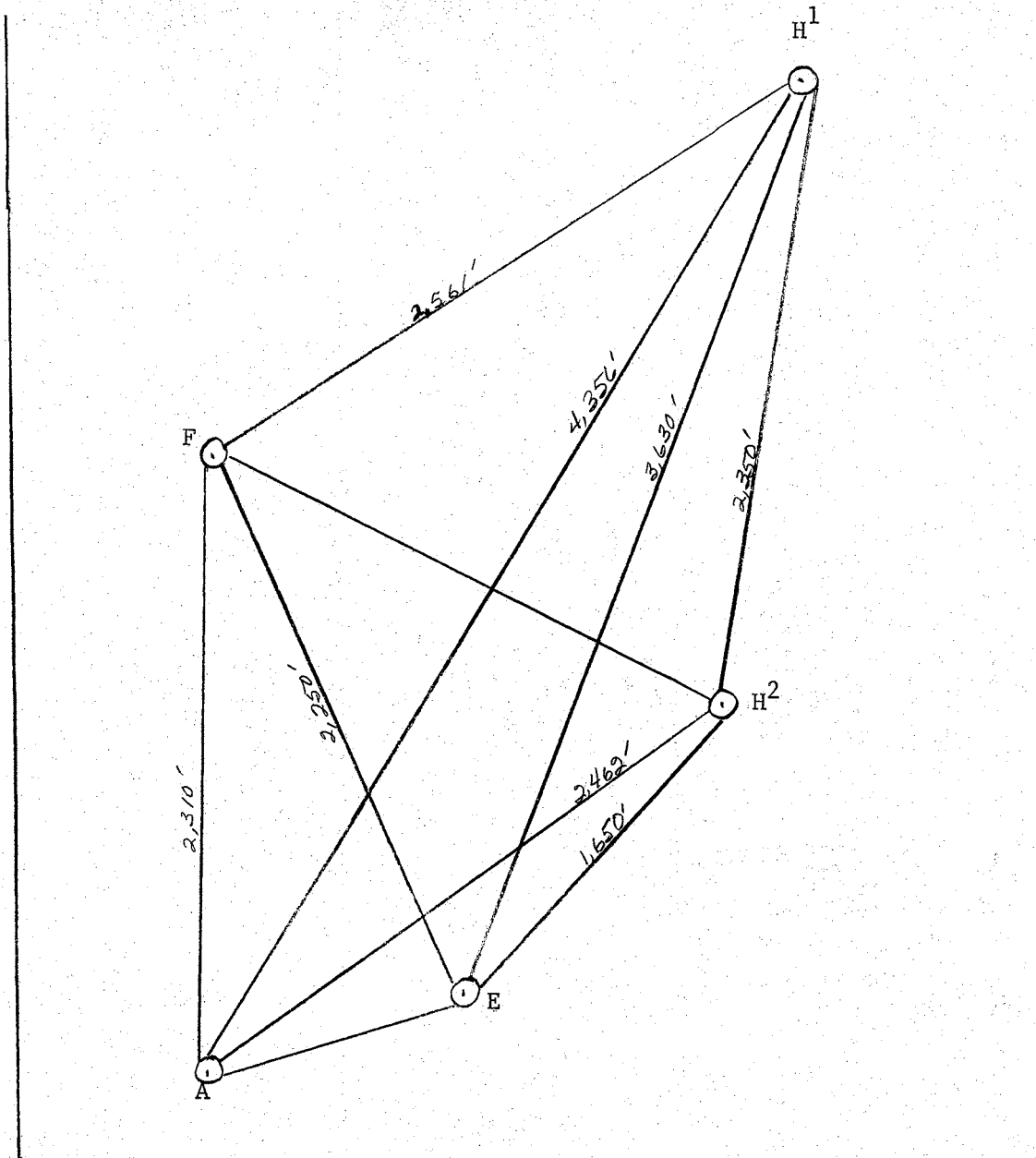


Figure 6. Relative Station to Station Trap Distances. These are linear distances given in feet.

Beside the above mentioned one-day occurrences station F area was not occupied by Harris' sparrow. It served only as temporary habitat for the fall arrivals from which the birds spread into other habitat.

Park (1934) noted the desertion of an area seemingly ideal for Harris' sparrows.

The winter of 1934-35 was generally mild with practically no snow yet for apparently no reason at all, the birds quit station "A", where they had been abundant through November and December, even though plenty of food was kept where it was easily accessible (Park, 1934).

Food was available in both a natural state and at the traps in abundance at station F. There was no severe weather during the period to cause major shifting. If the movement had been random and without some cause it seems likely the area would have been reoccupied. The phenomenon suggests that the general physical habitat is of major importance in the choice of winter range and the birds found the area surrounding station F lacking in some requirement.

It was possible to determine with some accuracy the fate of the birds trapped at station F. Twelve, all trapped during the last three weeks of November repeated a few times or were never retrapped, then disappeared. Assuming the correctness of the findings of other investigators (Park, 1935; Harkins, 1936; Baumgartner, unpub. ms.) it is presumed that the birds moved further south before settling down for the winter, or at least far enough from the study area that they were never located again.

The remaining 14 birds (54 percent) moved to adjoining areas and established residences. Birds 015 and 022, moved to area A, one-half mile south and established residence for the remainder of the study

period. Nine birds (010, 012, 016, 017, 018, 021, 023, 028, and 036) moved to area H¹, one-half mile east and were trapped and observed there over a subsequent three month period. One of the birds (010) was found dead beneath some shrubbery near station H¹ on March 13, 1962. One return bird, 465, was assumed to be resident in adjoining habitat and returned to station F on February 12, during a period of inclement weather.

Selection of permanent winter habitat may be delayed for several weeks after fall arrival. Some birds may visit a station from one to several times and disappear, leading to the assumption that the birds have moved farther south when in fact they may only have spread into nearby areas. Such was the case of 54 percent of the birds discussed above, a much higher percentage than was previously suspected.

During the fall period at station A, 17 birds were marked in November and December, while one bird was marked on January 6, 1962. Four were never trapped again. One return (089) repeated several times, then disappeared. Twelve birds established exchange patterns with station E and were considered area residents. Two birds (173 and 167) were killed by shrikes while in the trap on December 19, and January 11, respectively.

On January 5, a white plumed bird was found 1.6 miles north of station A. The bird remained in that area until April and was regularly observed. On January 8, another white plumed bird was reported 2.3 miles south of station A but was never seen again.

At station A, 84 percent of the birds trapped during the fall period became resident in the general area where they were banded and marked. The percentage was based on trap and sight records of individuals over a minimum period of three months.

At station E, no birds were trapped during November. In December, 13 new birds and 8 returns were trapped. By January, two more returns and one new bird were trapped for a total of 24 birds during the fall period. One adult bird never repeated; the remaining 23 established residence showing various patterns of exchange between stations E, A, H² and H¹. Number 025 was killed by a shrike on January 19. On December 11, two green-plumed birds (station E) were observed near station H² and on the following day 4 white-plumed birds (station A) were found there. After December 12, birds marked at stations A and E were frequent visitors at station H².

During a period of continuous snow and freezing weather, January 5 to 9, 1962, several shifts of marked birds were recorded. On January 5, a red-plumed bird was observed near station H¹. On January 10, a green-plumed bird was observed near station H¹.

After the previously mentioned period of severe weather no new birds were trapped at station A until February 3, 1962, and at station E until January 21. A decline in numbers of new birds trapped, marked the end of the fall period.

The Winter Period - The winter period began January 10, 1962, and extended to March 1, 1962, when a slight increase in population numbers indicated the onset of spring migration. Ten new birds and one return visited station A (during February) and in every case established themselves as residents by a pattern of exchange between traps A, E, and H². At station E, 13 new birds and two returns were trapped. Seven birds established exchange movement with stations A and H², while six never repeated.

During January, observation and trap data indicated a population

of 21 to 24 Harris' sparrows in the A, E, and H² areas. Sixteen of these birds were color-marked. Throughout the remaining winter period, twenty-four new birds were banded and color-marked at stations A, E, and H². Most of the new birds represented a sizable influx from nearby habitats but 5 to 8 of them probably were present as residents in the habitat, simply avoiding capture in the traps until this period. Eighteen of the 24 birds remained as residents, while 6 were trapped once and disappeared. This local movement from one habitat to another occurred during the mid-winter stable period and several birds actually took up residence in the new habitat.

The Spring Period - The spring period began during the first week of March, 1962, and extended for the duration of the study. Twenty-five new birds were marked, 14 at stations E - H² and 11 at station A. No returns were trapped. Only five birds established exchange movement between stations and only one made more than a single exchange movement. The remaining 20 birds were never identified again, with one exception (see page 22, white-plumed bird in area F).

The status of the birds trapped during the period of spring migration is difficult to ascertain. Lack of movement between stations and the small number of repeat records indicate a temporary status in the entire study area. The new birds were probably spring migrants moving through the study area or local birds from nearby habitats stimulated to move by the approach of the migratory period.

Overall Winter Movement

The birds trapped and marked at station H¹ have not been discussed

since an atypical situation existed there. Birds found here are discussed later (page 37).

In Table V are summarized the winter movement and status of individual birds trapped and marked in areas A, E, F, and H². The birds are listed in the order of dates trapped. Total number of exchange movement with other stations by each individual bird gives an index to the relative frequency and extent of movement. The age, months present, and band number for each bird is also given.

TABLE V
WINTER MOVEMENT AND STATUS OF HARRIS' SPARROWS
IN AREAS A, E, F, AND H²
FROM NOVEMBER TO MAY, 1961 - 1962

Date Caught	Age	Band Number	Months Present	Areas				Total Exg's	Status
				A	E	H ²	H ¹		
Area F									
Nov. 9	Im	61-168001	N				1	1	FM
Nov. 11	Im	61-168002	N				2	2	FM
Nov. 11	Ad	61-168003	N				1	1	FM
Nov. 13	Im	61-168005	N				1	1	FM
Nov. 13	Im	61-168006	N				2	2	FM
Nov. 13	Im	61-168007	N				1	1	FM
Nov. 14	Im	61-168008	N				1	1	FM
Nov. 14	R-4	54-121465	N, D, J, F				7	7	WR
Nov. 17	Im	61-168009	N				1	1	FM
Nov. 18	R-2	55-156869	N, D				4	4	WR-f
Nov. 19	Im	61-168010	N, D, J, F, Mr				2	3	11 WR
Nov. 19	Ad	61-168011	N				1	1	FM
Nov. 21	Im	61-168012	N, D, J, F				1	2	1 WR
Nov. 22	Im	61-168013	N				1	1	FM
Nov. 23	Im	61-168014	N				1	1	FM
Nov. 25	Im	61-168015	N, D, J, F, Mr, A, Ma	33	8	1	1	43	12 WR
Nov. 25	Ad	61-168016	N, D, J, F				1	4	5 1 WR
Nov. 25	Im	61-168017	N, D, F				1	1	2 1 WR
Nov. 25	Im	61-168018	N, D, J, F				1	1	2 1 WR
Nov. 29	Im	61-168020	N				1	1	FM
Nov. 29	Im	61-168021	N, D, J, F, Mr, A				10	1	11 1 WR

TABLE V (Cont.)

Date Caught	Age	Band Number	Months Present	Area					Total Exg's	Status	
				A	E	H ²	H ¹	F			
Nov. 29	Im	61-168022	N,D,J,F, Mr,A	16	4	1		1	22	11	WR
Nov. 30	Im	61-168023	N,D,J,F, Mr					6 3	9	3	WR
Dec. 10	Im	61-168028	D,J,F					3 11	14	1	WR
Dec. 19	Im	61-168036	D,J,F					2 1	3	1	WR
Jan. 11	Im	61-168039	J					1	1		LM
Area A											
Nov. 16	Im	58-107166	N,D,J,F, Mr,A, Ma	1		1			2	1	WR
Nov. 17	R-1	58-107089	N,D,	4					4		WR
Nov. 27	Im	58-107167	N,D,J	3	4				7	4	WR-f
Nov. 27	Im	58-107170	N	1					1		FM
Nov. 28	Im	58-107168	N,D,J,F, Mr,A	2		1			3	1	WR
Nov. 28	Im	58-107169	N,D,J,F	18	3				21	6	WR
Nov. 30	Im	58-107171	N,D,J,F, Mr,A	3	12	8			23	12	WR
Nov. 30	Im	58-107172	N	1					1		FM
Nov. 30	Im	58-107173	N,D	7	2				9	2	WR-f
Nov. 30	Ad	58-107174	N,D,J,F, Mr,A, Ma	81	9				90	14	WR
Dec. 1	Im	58-107175	D,J,F,Mr, A, Ma	15	10				25	10	WR
Dec. 4	Ad	58-107176	D,J,F,Mr	1	2				3	1	WR
Dec. 6	Im	58-107177	D	1					1		FM
Dec. 11	Im	58-107178	D,J,F,Mr, A	6	6	12			24	9	WR
Dec. 11	Im	58-107180	D,J,F,Mr, A	9	10	3			22	10	WR
Dec. 13	Im	58-107181	D,J,F	9	8	3			20	16	WR
Jan. 6	Im	58-107185	J	1					1		LM
Feb. 3	Im	58-107190	F,Mr,A	3	2				5	2	LM-R
Feb. 15	Ad	58-107191	F	1					1		LM
Feb. 16	Im	58-107193	F,Mr,A	10	3				13	4	LM-R
Feb. 16	R-2	55-156885	F	2					2		LM
Feb. 17	Im	58-107194	F,Mr	4	3				7	3	LM-R
Feb. 17	R-1	58-107089	F	4					4		LM
Feb. 18	Ad	58-107195	F,Mr	3	1				4	1	LM-R
Feb. 19	Ad	58-107196	F,Mr,A	16	1				17	2	LM-R
Feb. 20	Im	58-107197	F,Mr,A	4	2	1			7	2	LM-R
Feb. 22	Im	58-107198	F,Mr,A	4	1	2			7	4	LM-R
Feb. 23	Im	58-107199	F,Mr,A	2	2	1			5	2	LM-R
Feb. 25	Im	58-107200	F,Mr,A	4	2	1			7	4	LM-R

TABLE V (Cont.)

Date Caught	Age	Band Number	Months Present	Area				F	Total	Total Exg's	Status
				A	E	H ²	H ¹				
Mar.10	Ad	62-171501	Mr	1					1		SM
Mar.25	Im	62-171502	Mr,A	8					8		SM
Mar.29	Im	62-171504	Mr,A,Ma	16	2				18	3	SM
Mar.29	Im	62-171505	Mr,A	7					7		SM
Apr.2	Im	62-171506	A,Ma	11					11		SM
Apr.17	Ad	62-171507	A	2					2		SM
Apr.18	Im	62-171509	A	1					1		SM
Apr.20	Im	62-171510	A,Ma	4					4		SM
Apr.21	Im	62-171511	A,Ma	4					4		SM
Apr.22	Ad	62-171512	A	1	1				2	1	SM
Area E - H ²											
Dec.6	Im	61-168024	N,D,J,F, Mr	52	7				59	11	WR
Dec.6	R-3	54-121590	D,J		5	1			6	1	WR
Dec.6	Im	61-168025	D,J	8	4				12	3	WR-f
Dec.6	Im	61-168026	D,J,F	1	3	1	3		8	3	WR
Dec.7	R-2	55-156873	D,J	1	4				5	2	WR
Dec.10	R-4	54-121461	D,J,F	1	4	3			8	3	WR
Dec.10	Im	61-168027	D,J,F,Mr, A,Ma	75	4				79	7	WR
Dec.10	Im	61-168029	D								
Dec.11	Ad	61-168030	D,J,F,Mr, A	1	5	5			11	7	WR
Dec.11	Im	61-168031	D,J,F,Mr, A	3	14	11			28	11	WR
Dec.11	R-2	58-107023	D,J,F	2	4	2			8	2	WR
Dec.11	R-5	53-197479	D,J,F,Mr, A		2	4			6	3	WR
Dec.13	Im	61-168032	D,J,F,Mr, A		1	3	8		12	3	WR
Dec.14	Im	58-107182*	D,J,F,Mr, A,Ma	10	11	6			27	15	WR
Dec.17	R-2	55-156880	D,J,F		3	1			4	1	WR
Dec.18	Im	61-168033	D,J,F,Mr	2	4				6	3	WR
Dec.19	Im	61-168034	D,J,F,Mr A	2	5	7			14	8	WR
Dec.19	Ad	61-168-35	D		1				1		FM
Dec.19	R-2	58-107090	D,J,F,Mr	1	3	3			7	6	WR
Dec.20	R-1	58-107097	D,J		3				3		WR
Dec.20	Ad	61-168037	D,J,F		4	2			6	1	WR
Jan.5	Im	61-168019	J,F	1	2	1			4	3	WR
Jan.5	R-4	54-121475	J,F,Mr,A		2	4			6	3	WR
Jan.8	R-4	54-121501	J,F,Mr,A		4	5			9	3	WR
Jan.20	Im	61-168041	J,F,Mr,A	1	3	9			13	2	LM-R
Jan.23	Ad	61-168063	J,F,Mr,A		1	7	1		9	3	LM-R
Jan.23	Im	61-168064	J,F,Mr		3	3			6	3	LM-R

TABLE V (Cont.)

Date Caught	Age	Band Number	Months Present	A	E	H ²	H ¹	F	Total	Total Exg's	Status
Jan.23	Im	61-168065	J		1				1		LM
Jan.28	Im	61-168083	J		1				1		LM
Jan.30	Im	61-168-88	J,F,Mr,A	3	1				4	1	LM-R
Feb.1	R-5	53-199446	F		1				1		LM
Feb.5	R-1	58-107086	F		1				1		LM-R-f
Feb.11	Ad	61-168112	F		1				1		LM
Feb.16	Ad	61-168115	F		1				1		LM
Feb.20	Ad	61-168116	F		1				1		LM
Feb.24	Im	61-168117	F,Mr,A	6	11				17	5	LM-R
Mar.2	Ad	61-168155	Mr		1				1		LM
Mar.8	Ad	61-168159	Mr,A	3		1			4	1	LM-R
Mar.8	Ad	61-168160	Mr			1			1		LM
Mar.8	Ad	61-168161	Mr			1			1		LM
Mar.8	Ad	61-168162	Mr,A	6		1			7	1	LM
Mar.8	Ad	61-168163	Mr			1			1		LM
Mar.29	Ad	61-168190	Mr,A			4			4		SM
Apr.1	Im	61-168191	A			3			3		SM
Apr.2	Im	61-168192	A		1	1			2	1	SM
Apr.17	Im	61-168204	A		1				1		SM
Apr.30	Ad	61-168205	A		1				1		SM
May.1	Im	61-168206	Ma		1				1		SM
May.1	Im	61-168207	Ma		1				1		SM

* Marked at E but escaped before banding and consequently has a band number from station A where it was captured next.

WR - Winter resident; FM - Fall migrant; SM - Spring migrant;
 LM - Local movement; LM-R - Local movement became resident;
 f - fatality.

Among 115 birds (Table V), 17 were fall migrants and 18 were spring migrants, staying in the area for several days at the most and then moving on. Birds classed as migrants exhibited no exchange movement within the study area, remaining no longer than one month. Forty-eight became residents of the several station areas based on their presence over a minimum period of three months. Thirty-two birds moved into the study area and 17 of them remained as residents while 15 apparently moved again. Since most of the birds in the station areas had been marked by mid-January any new bird moving into the area was

considered to have come from adjacent habitat or been present but not trapped previously. If they remained they were considered resident.

Exchange between station areas was frequent and several patterns of exchange are apparent upon analysis of data in Table V. Among the resident birds, 42 visited at least two stations, 23 visited 3 stations, and three birds visited 4 stations. Exchange movements varied from one-fourth to three-fourths mile or more in distance.

Two types of winter residents were found; birds that became resident during the fall settling period, and birds that moved into the area during periods of severe weather, remaining until spring migration. No apparent difference in the frequency or extent of movement was found between the two classes.

A typical resident, 61-168031, was first trapped December 11, 1961, at station E during an ice storm, repeated at station E on December 18, 19, and 20 and was not caught again until January 5 and 6, 1962. It moved up the timbered ravine about 1,000 feet to the trap at station A on January 7; back at station E January 20 and 25; 1,650 feet across an open residential area to station H², January 29, 30, and 31; at station E, February 6, and back to station H², February 10. On February 10, it was given an individual mark composed of one green and one yellow feather. Later, the same day, it was observed to move by short flights from station H², west into several brushpiles and eventually to the vicinity of station E; up the timbered ravine containing stations A and E; eventually to a point west of station A; later that day 031 returned to station H². The same pattern of movement was observed repeatedly after individual marking enabled the observer to follow the bird's flight. The data suggests that daily movement from 1,000 to 2,700 feet

is not uncommon for Harris' sparrow. During the remainder of the study, the bird was trapped 4 times at station E, twice at station A, and 7 times at station H². It was observed regularly in these areas each day even though it did not enter the trap. It was last observed on May 1, 1962, but never was it observed outside the limits described above.

From observations of several individually marked birds, in a manner described above, it is apparent that the frequency and extent of movement is much greater than would be expected from trap records alone. Ten other individually marked birds (178, 181, 180, 171, 015, 023, 182, 026, 021, and 063) were observed to make daily exchange movements of 1,000 to 2,700 feet following the same pattern exhibited by number 031.

Extent and Frequency of Winter Movement

It has been noted earlier (Table V), that a considerable amount of exchange movement between trap areas occurred. The distances involved are quite varied. Birds ranged 700 feet around the trap site and the ranges of distance set in Table VI, include the 700 feet.

Data (Table VI) show the extent and frequency of movement for the local winter resident birds from stations A, E, F, and H², throughout the entire study. Movements are taken from trap records in chronological order and in some instances a full one-half mile movement is represented as two one-fourth mile movements when the bird visited a station intermediate between stations. Table VI contains fewer 2,000 to 3,000 foot movements than actually occurred.

Movements of 1,000 to 1,500 feet units were most frequent. Movements of one-fourth to one-half mile were common while movements beyond 3,000 feet were few. The frequency of movement was greatest in January and February while the weather was most severe.

TABLE VI
 DISTANCE AND FREQUENCY OF WINTER MOVEMENT FOR A
 RESIDENT POPULATION OF HARRIS' SPARROWS

Month	Marked Birds Present	Linear Distances of Movement in Feet			
		1,000-1,500	2,000-3,000	3,000-5,000	5,000 plus
November	16	0	0	0	0
December	41	33	2	0	0
January	48	67	10	1	2
February	58	55	15	2	0
March	62	23	3	0	0
April	63	15	5	0	0
May	63	4	0	0	0

From November, 1961, to February 28, 1962, fifty-two birds became resident in the areas of stations A, E, and H². Five of the birds were killed, 3 by shrikes and two from injury incurred at the trap. None of the individual birds remained constantly in one station area but exhibited varying patterns of exchange with other stations. Data in Table V indicate that certain individuals were trapped mainly at one station but all visited other habitats. A summary of activity for the 52 individuals is shown in Table VII.

Eighteen birds (34.6 percent) exhibited movements from 1,200 to 1,500 feet. Thirty birds (57.7 percent) revealed regular movements from 1,200 to 3,000 feet while four birds (7.7 percent) showed movements of 5,000 feet.

The birds in areas A, E, and H² were loosely associated into two groups. One group was located in the upper end of the ravine around station A and the other downstream about 1,000 feet around station E. Birds from both areas frequently moved east across an area of new housing development into the sanctuary of station H². Station H² did

not contain a population of its own but held birds from A and E on occasion. Movement between stations A and E was daily and some birds repeated at both stations in a single day. The two groups overlapped and mixed constantly. On several occasions most of the individuals of

TABLE VII
STATIONS VISITED AND EXTENT OF MOVEMENT FOR
52 RESIDENT HARRIS* SPARROWS

Number of Birds	Stations Visited	Distance
First Trapped at E		
9	E - A - H ²	1,200 - 3,000 feet
9	E - H ²	1,500 - 2,000 feet
7	E - A	1,200 - 1,500 feet
2	E - H ² - H ¹	1,500 - 5,000 feet
1	E - A - H ² - H ¹	1,200 - 5,000 feet
1	E - A - H ¹	1,200 - 5,000 feet
First Trapped at A		
11	A - E	1,200 - 3,000 feet
8	A - E - H ²	1,200 - 3,000 feet
2	A - H ²	2,500 - 3,000 feet
2	*F - A - E - H ²	1,200 - 3,000 feet

*Initially trapped at station F

both groups congregated at a favorite brushpile mid-way between A and E (Figure 5). When alarmed, they would separate, some flying up and some flying down the ravine but a particular bird could not always be expected to go in the same direction each time. A loose association of

birds existed, with constantly changing individual composition. No aggressive activity toward their own species or other species was observed. Of the 52 birds, 29 visited 2 stations, 20 visited 3 stations and 3 visited 4 stations. All exhibited a local winter movement which fell into the 1,000 to 3,000 foot range. Repeats at two stations on the same day, one-fourth mile apart occurred 17 times.

In moving from place to place, Harris' sparrow was observed to follow two methods. In some instances they would launch themselves and fly for considerable distances, crossing segments of open habitat, before alighting. Flights of this type were usually made singly. A more usual method was to move by short flights from one place to another in groups of two to ten birds. More or less fixed landmarks were used and travelways were established which incorporated the same trees, thickets or brushpiles. Birds from stations E and A, established a definite travelway into the station H² area. In moving from E to H², the birds used the tops of several large trees which had survived the clearing of the ravine for house sites, dropped into a brushy tangle, flew about 500 feet into a brushpile, another 500 feet into another brushpile and weedpatch and then into the area around station H². In movement in the opposite direction the procedure was reversed. The same route was used repeatedly.

The actual extent of winter movement by resident birds has not been determined for Harris' sparrow. Park (1935) thought the birds followed a general course along a stream or ravine rather than a haphazard pattern. He noted one three-fourth mile movement along a small tributary stream. Harkins (1936) did not give records of movement and thought the birds did not roam extensively but were localized in desir-

able habitat. Two instances of winter movement were noted by Steelman and Herde (1937); a bird trapped March 3, 1937, repeated at a trap site 1.25 miles north of the first station on May 3, 1937, (probably a spring migrant) and a bird released in Stillwater, Oklahoma, repeated at a trap between the city and its original trap station. Baumgartner, (unpub. ms.) released several marked birds in 1948 which were subsequently observed principally within a few hundred yards of the station. Several of the birds were seen at distances of one-fourth mile downstream from the trap and one bird was observed to move about one-half mile.

Factors Influencing Winter Movement and Wandering

The complete population shift from station F, has been attributed to some unknown factor or factors present in the physical habitat. Food and weather conditions could not be responsible.

Only two instances of wandering were found, one 1.5 miles movement and one 2.3 mile movement. Both occurred during the period of fall settling and did not represent movement of birds which had established permanent winter range (see page 25).

Movement within the habitat was frequent. The greatest amount occurred in January and February which were the coldest, stormiest portions of the winter. The greatest influx of birds occurred in these months. Some correlation between cold or severe, inclement weather and the frequency of movement is suggested.

Swenk and Stevens (1927) thought movement within the winter area might be due to weather conditions, food supply or seasonal abundance of birds. In studies using tree sparrows, winter storms were found to increase the winter movement (Sargent, 1959). Baumgartner (1938)

studying tree sparrows found a correlation between movement and three factors; fall settling, spring excitement (pre migratory wandering), and midwinter storms. In a later study of Harris' sparrow (Baumgartner, unpub. ms.) a correlation between winter storms and the influx of new birds presumably from adjacent habitat was found. She also found some variation in the population due to changes in the habitat.

Harris' Sparrows At Station H¹

In an effort to locate birds which had deserted station F, field observations were begun at station H¹ on December 29, 1961. Continued observations at station H¹ resulted in finding increasing numbers of Harris' sparrows several of which were feather-marked. A trap was set in operation. An unusually large concentration of Harris' sparrows was located at station H¹. Mr. and Mrs. Owen Harned who owned the property, maintained a heavy feeding program for birds, providing several pounds of scratch feed each day. The food was scattered about on the lawn and beneath shrubbery. Adjoining the lawn-cultured habitat on the north were two other community types including a timbered ravine and disturbed-cultivation type. The area comprized a desirable habitat plus an abundance of food. A picture of the area is shown in Figure 3.

One hundred-thirty-two birds were color-marked with lilac feathers. Nine red-plumed birds which had established residence were identified at station H¹. Three green-plumed birds from stations E and H² moved into the area but no birds from station A were located.

Although many birds moved into the area, few were known to have moved out. Only one record of movement from area H¹ was obtained. On March 17, 1962, a lilac feathered bird was observed at a feeding station

one mile north of H¹. An extremely stable population of birds was present. They ranged north from the lawn area into a timbered ravine and on occasion west into an open ravine containing a few shrubs and weed patches, a distance of 2,000 feet which was covered by most of the birds daily.

The habitat, comprising approximately 25 acres, supported a population of 125 birds. It represented ideal Harris' sparrow habitat, providing protection from predators, abundant food and cover. There was limited exchange movement of birds to other habitat although many new birds moved into the area.

A population of about 125 birds was maintained until the second week of April when the population dropped to 75 birds and continued to decline until the last spring record on May 8, 1962, when one bird was recorded.

DISCUSSION

The winter habitat of Harris' sparrow described in the study is in agreement with other investigators (Swenk and Stevens, 1929; Nice, 1929; Baumgartner, unpub. ms.) as being limited to the wooded ravines, weed patches and hedgerows. The study area contained two ravine systems which held the largest concentration of Harris' sparrows.

Three more or less distinct units of suburban development were included in the study area and influenced the distribution of Harris' sparrow. The first two units including newly developed subdivisions and areas in which house construction was still in progress were almost completely avoided by Harris' sparrow. Their presence here was a rarity, occurring only in times of stress brought about by winter storms when the birds were in search of food. The third unit containing widely scattered houses with extensive plantings of trees and shrubs interspaced with lots and small pastures provided habitats that were used regularly by the birds.

During the study, many new houses were constructed and portions of the habitat were destroyed to make room for them. At trap E, during the last three weeks of the study a reduction of captures was evidently the result of activities at a new home construction site just across the stream, 500 feet from the trap.

Harris' sparrows are definitely birds of the country and will not tolerate intensive suburban development, remaining in an area only when

sufficient natural habitat persists. Acreages within the residential areas did attract a number of birds particularly when some supplemental food and protection from predators was provided.

The apparent selection of some central headquarters site within the habitat by Harris' sparrow as a gathering point for the group has not been previously noted in the literature. The headquarters site was usually a brushpile but in one case a vine covered tree was used. At the headquarters site some portion of the local population could generally be found throughout the day. The value of such sites as a factor in habitat selection by Harris' sparrow and the degree of occurrence is not known and deserves further investigation.

The association of Harris' sparrows into loosely constructed groups showing little flock tenacity was not expected. The only point which remained constant was the approximate size of the group. The individual composition of the group changed daily. A bird might spend one day at the head of a ravine with one group and a few hours later on the same day appear at the lower end of the ravine with another group. At times both groups would congregate midway between these points. A more extensive program of individual marking is needed to reveal the specific social structure of the species.

In the paper, the winter period is separated into three divisions including, fall settling, midwinter stable and spring migratory periods. The separation cannot be considered as a static division but is a general division for which definitive dates cannot be applied. Discussion of the winter residence is facilitated by a division of this type, but the occurrence of severe weather in mid-December might shorten the fall settling period by several days or the advent of extremely mild spring

weather may encourage an early spring migration. Changes in the habitat by fire, housing development or other disturbances could also change the beginning and duration of a given period.

The location of trap sites was arbitrary and the sites were selected with regard to favorable habitat and spaced to give adequate information on the extent and frequency of movements. The trap stations were placed in a favorable spot within the habitat so as to expose the greatest number of birds to the trap. It was not possible to capture all the individuals which visited the trap but the uncaptured individuals were few. Several birds which were captured once or twice remained in the areas as residents, simply failing to enter the trap again and it was not possible to give them positive identification or status in the study. Dependence upon trap bait was negligible except during periods of winter storms when natural food was difficult to obtain. A few birds did develop the "trap habit", repeating 50 to 75 times at one trap, but even these individuals showed occasional exchange patterns with other stations, similar to birds which did not show "trap habit".

The study area of 480 acres, including two ravine systems and 5 trap stations within a one mile radius was adequate to give accurate data on Harris' sparrow populations, frequency and extent of movements. A smaller study area would not give adequate information on these points. The presence of two or more ravines is very important to a study of Harris' sparrows since they tend to concentrate in this habitat type.

It is probable that a more extensive program of individual marking, involving an increase in distance and number of trap stations and a study area including additional ravine systems would result in still farther extension of the size of the local winter range or territory of

Harris' sparrow. There is still much to be discovered concerning the winter activities of the bird. Several aspects touched on in this paper deserve more careful study, especially the social behavior and conditions affecting the birds winter activities.

SUMMARY

1. Field studies were made of a population of Harris' sparrows Zonotrichia querula (Nuttall), from November, 1961, to May, 1962, near Stillwater, Oklahoma.
2. Two hundred-forty-seven birds were trapped, banded and marked with extraneous, colored chicken feathers at five trap stations located from 1,000 to 4,650 feet apart within a 480 acre study area.
3. The general study area contained five community types, based upon land use and vegetation present: Tallgrass prairie, Residential-Subdivision, Disturbed-Cultivation, Lawn-Cultured and Timbered ravine types.
4. The bulk of the birds arrived during the second and third weeks of November (early date was November 3, 1961), and declined to a stable number during December, January, and February. During late March, a slight increase in numbers indicated the spring migration, after which the population declined to a last observation date of May 8, 1962.
5. The ratio of immature to adult birds varied from a 3:1 ratio in November, December, and January, to a 1:1 ratio in February and March.
6. Sixteen returns were trapped. Thirty-eight percent of the returns repeated at the original trap station while 62 percent "skipped" the original station but were found present in adjacent habitat.

7. Winter habitat of the bird was predominately of the timbered ravine type associated with areas of disturbed-cultivation containing seed producing weed patches. Expanses of lawn were used occasionally while the open prairie and residential areas were seldom visited.
8. Brushpiles and vine-covered trees were utilized as headquarters areas for groups of birds within the study area and some portion of the population could usually be found at these spots.
9. Certain travelways between suitable habitat were followed regularly.
10. Desertion of seemingly ideal habitat could not be attributed to food or severe weather.
11. The frequency of movement increased from November to a peak in January and February, after which the frequency of movement declined. The frequency was in direct correlation to periods of severe weather, with more movement being found during periods of severe weather.
12. Among resident birds, regular movements of 1,000 to 3,000 feet were found in 57.7 percent, movements of 1,000 to 1,500 feet were found in 34.6 percent and 7.7 percent exhibited movements up to 5,000 feet.
13. Two cases of winter wandering were found. One bird moved 1.5 miles, the other 2.3 miles; both movements were attributed to fall settling previous to the establishment of permanent winter residence.
14. In an area of ideal habitat, 132 marked birds exhibited daily movement of 2,200 feet. Only one of these birds was found to have moved from the area.

15. No territoriality was observed. The birds exhibited no flock tenacity but were associated into loose aggregations which changed their individual structure frequently.

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VITA

Donald Dean Bridgwater

Candidate for the Degree of

Master of Science

THESIS: WINTER MOVEMENT AND HABITAT USE BY THE HARRIS' SPARROW,
Zonotrichia querula (Nuttall)

Major Field: Zoology

Biographical:

Personal Data: Born at Dodge City, Kansas, October 9, 1938,
the son of Vernon E. and Veva Frances Bridgwater; is married
and the father of two children.

Education: Attended grade school in Ford and Paradise, Kansas;
attended high school at Paradise and Cimarron, Kansas, and
was graduated from Cimarron Consolidated High School in 1956;
received the Bachelor of Science degree from Bethany Nazarene
College, with a major in Biology, in May, 1961; completed
requirements for the Master of Science degree in August, 1963.

Professional experience: Instructor in the Department of
Biological Sciences, Bethany Nazarene College, Bethany,
Oklahoma, beginning September, 1962.

Member of: American Society of Mammalogists, American Ornith-
ologist' Union, The National Association of Biology Teachers,
The Oklahoma Academy of Science, Phi Sigma.