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MOVEMENT OF WILD TURKEY HENS IN RELATION TO THEIR NESTS¹

by

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ABSTRACT

Wild turkeys (*Meleagris gallopavo osceola*) on a study area in Florida nested 1.4 miles from winter release sites and 1.2 miles from their late winter range. Net distance and direction of movement of 12 hens from winter range to nesting sites was only about 0.2 miles west. The hens usually roosted within one mile of their nests during the laying period (mean distance 0.8). Renesting was within one mile (mean 0.8) of the first nest. Two hens radio-tracked during the laying period used 100 to 200 acres daily and usually roosted less than one mile from their nests. Laying was in late morning through early afternoon. Hens tended to visit their nests for about one hour during the first half of the laying period, but remained progressively longer with each egg laid after the sixth or seventh. During the period of incubating behavior, hens left their nests about every two days (mean 1.86) for about two hours (mean 1.95) but were extremely variable in this. They were six times more frequently absent from their nests in mid-morning or late afternoon than at noon. One hen continued incubating behavior on a clutch of infertile eggs for 64 days. Some management implications are discussed.

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INTRODUCTION

The difficulty of finding wild turkey nests has hindered studies on turkey reproduction. Very recent accounts (Hewitt 1967 and Lewis 1973) mention reproductive behavior in only general terms and most discussions of the subject in the literature cite a mimeographed preliminary report that was based on captive turkeys (Blakey 1937) as their major source of information. In our studies on a population of wild turkeys using radio-tracking techniques we observed and can now document movement behavior of nesting hens that has not been reported before.

Movement behavior is an important attribute of the wild turkey that has considerable bearing on optimum management unit size, ideal habitat composition, the spacial aspects of disturbance by human activity, and the best placement of openings, plantings and burnings. But sound knowledge of wildlife biology, including the behavior of turkeys, is needed for many as yet unforeseen management needs. We believe that efforts to acquire such basic knowledge should not await the general acceptance of the need for it.

We would like to thank Lykes Brothers, Inc. for the use of Fisheating Creek Wildlife Management Area and for the generous cooperation of Charles P. Lykes and Ben Swendsen. Aircraft pilots Lewis Conrad and Joe Brannen helped locate missing turkeys. Larry H. Barwick, William B. Frankenberger, and Ray McCracken assisted with the field work. H. N. Webster generously developed and constructed some of the electronic equipment. John B. Lewis and Dan W. Speake made helpful suggestions on the manuscript.

METHODS

The study was conducted on Lykes Fisheating Creek Wildlife Management Area near Lake Okeechobee in Glades County, Florida. The terrain there is flat, between 30 and 55 feet above mean sea level. Annual rainfall is about 50 inches; the climate is subtropical with rare and only brief sub-freezing winter temperatures.

The principal habitat types used by the turkeys were 1) a narrow ecotone between prairie and creek flood-plain, for nesting; 2) a zone of grassy openings between the nesting cover and cypress woods, used to cross between nest and woods; and 3) cypress woods containing small openings and thin stands of trees with heavy ground cover of grasses and forbs (Fig. 1). Other cover on the study area was not used to a significant degree. The study area has been described in more detail elsewhere (Williams et al 1973).

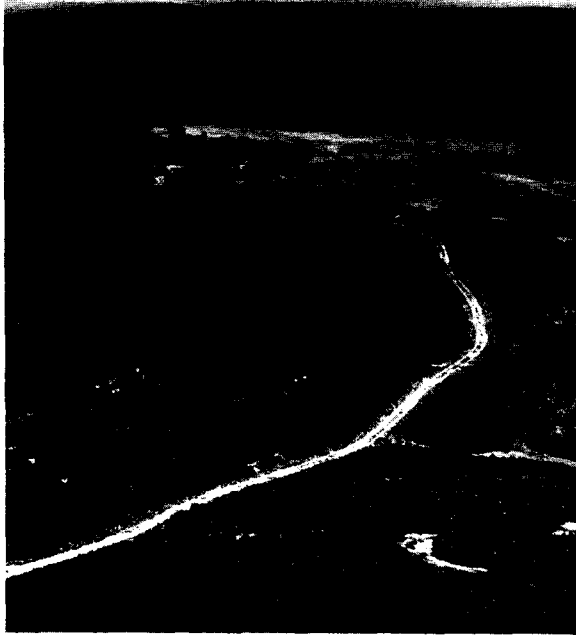


Figure 1. Habitat composition on the study area. Upper right is cypress woods; lower and middle (along road) is nesting habitat; between is grassy zone (at upper end of road).

The turkeys were native wild stock, captured with tribromoethanol (Williams et al 1973) or cannon nets (Austin 1966) from January through March. Turkey handling procedures have been described in another paper (Austin et al 1973). Turkeys were banded with riveting aluminum bands and fitted with radio transmitters that weighed from 50 to 90 grams and emitted pulsed signals between 150.815 MHz and 151.210 MHz. Operating range was about one mile; operating life was about 150 days. Twenty-four-channel crystal-controlled receivers were used with hand-held and truck-mounted yagi antennas. The radio equipment has been described (Williams et al 1969).

Positions were plotted from two or more radio bearings taken at fixed stations. Accuracy varied with the skill of the operator, distance and other factors, but trial plottings with transmitters at known locations about 1,000 yards away were usually within 150 yards of the target. In crucial situations, accuracy was improved by approaching the signal source more closely.

Most of the positions on the maps (Figs. 2 through 9) are based on roost fixes because radio range was greater at night with the turkeys roosting in trees and this facilitated plotting. Most of the quantitative data were obtained from 15 hens that were radio-tracked before and while nesting; from 11 nests observed visually at blinds; and from 10 nesting attempts monitored by an electronic recorder. These data accurately reflect our impressions based on observations made of 174 hens and 139 nests during

Table 1. Movement and range parameters of fifteen nesting hens based on roost locations.

Hen No.	Age Class	Distance (Miles)					Ranges (Acres) ³			During Entire Laying Season ⁴
		Release Site To Nest	Greatest Away From Nest ¹	Winter Range To Nest ²	Between 1st & 2nd Nests	Two Weeks Before Nesting	While Laying	Between 1st & 2nd Nests		
10P7	Adult	1st 0.2	1.0	0.7 West	1.9	---	360	---	---	
		2nd 1.7	---	---	---	---	---	---	---	
11P2	Adult	1st 1.0	0.7	1.5 West	0.3	---	320	---	340	
		2nd 1.3	0.8	1.8 West	---	---	---	---	---	
10P9	Adult	2.4	1.5	2.0 East	---	---	210	---	---	
		0.7	0.5	1.7 West	---	---	140	---	140	
13P2	Adult	0.3	0.6	0.6 West	---	---	170	---	---	
		4.0	0.5	3.5 East	---	---	---	---	---	
9P18	Adult	1st 0.7	0.5	0.0	0.7	---	---	---	380	
		2nd 1.3	0.7	0.5 West	---	---	100	---	---	
7P9	Adult	1st 0.2	0.9	1.0 West	0.2	150	---	---	430	
		2nd 0.2	1.3	0.8 West	---	---	---	---	---	
2P7	Sub-Adult	1st 0.7	0.9	0.6 West	0.5	---	160	140	210	
		2nd 0.3	0.5	0.3 West	---	---	---	---	---	
19P1	Adult	0.9	---	0.0	---	---	---	---	---	
		1st 2.5	0.6	---	1.0	---	---	---	350	
16P2	Adult	2nd 2.9	---	---	---	---	---	---	---	
		1.5	0.6	2.0 East	---	---	---	---	---	
24P5	Sub-Adult	1.4	0.5	---	---	---	---	---		
12M	Adult	1.0	0.9	---	---	c.700	---	---	c.700	
11P	Sub-Adult	5.0	---	0.8 South	---	---	---	---	---	
20M	Adult	1.4	0.8	1.2 ⁵	0.8	---	195	---	364	
Mean	Standard Deviation	1.3	0.3	0.9	0.6	---	97.1	---	179.0	

¹While laying; for each nest, if more than one.

²Measured from approximate center to pre-nesting range to the nest.

³Area within the outermost roost fixes during the period in question, rounded to nearest 10 acres, calculated only when one-half the total number of roost places were known.

⁴Period from the first egg laid to the end of the last known nesting attempt, including all plots made.

⁵Net movement was 0.20 mile west; north-south movement was not calculated.

Table 2. Nest attentiveness of 8 hens automatically recorded during the period of continuous incubating behavior.

Channel No.	Date Incubating Began	Number Whole Days Monitored	Times Left Nesta	Mean Interval (Days)	Mean Time Off Nest (Minutes)	Standard Deviation (Minutes)	Extremes of Time		Occurrences		Occurrences	
							Off Nest (Minutes)	Off Nest (Minutes)	Off Nest Before Noon	Off Nest Afternoon	Off Nest During Noon	Off Nest During Noon
8P4	11 Apr	26	13-14b	2.00-1.86	80.2	46.7	3-786	6	6	1		
4P3	22 May	29	13-14b	2.23-2.07	132.7	113.7	36-487	1	11	1		
2P5	18 Apr	26	15-16b	1.73-1.63	69.7	33.5	34-777	2	9	4		
21P2	12 May	25	23	1.09	97.5	49.3	63-259	4	15	4		
9P6	19 Apr	25	10-11b	2.80-2.55	245.1	294.3	60-937	2	5	2		
11P3	17 May	17	8-9c	2.13-1.89	117.4	57.1	75-231	2	2	1		
13P2	20 Apr	25	13-13b	1.92-1.79	115.4	58.7	64-295	5	8	1		
16P2	17 May	22	15	1.47	79.6	17.6	55-111	7	6	0		
MEANS & TOTALS				1.86	117.2		3-937	29	62	14		

a Final departure with brood not counted.

b One and 2-day errors in this column are missing data due to malfunctions in the automatic recorders. These errors are accounted for in all calculations.

c Not counting the time this hen was frightened on 8 June from her nest by the predator that destroyed the nest.

the nine years of study. Various portions of this long-term study have been reported: nesting habitat (Williams et al 1969), nesting behavior and clutch data (Williams et al 1972), and brood behavior (Williams et al 1973).

Nest attendance data (Table 2) were obtained on eight hens (in 10 nesting attempts) in 1973 and 1974 by an automatic device that received a low-powered signal from a transmitter on a hen at the nest, converted the frequency and retransmitted the signal about four miles to headquarters where the signal there activated an electronic switch. The absence or presence of the hen was recorded on a 30-day time-calibrated, clock-driven chart of an Esterline-Angus event recorder.

Locations of two hens (Fig. 10) were plotted bi-hourly during the laying period in April 1971. Distances were measured on maps and graphed to show the distance from the nest at various times during the day and while roosting (Fig. 11).

Tracking in late winter was to detect possible shifts from winter to nesting range and tracking during spring was to determine the range used by nesting hens in relation to the placement of nests. Range areas were calculated by the dot grid method and rounded to the nearest 10 acres. Parts of some maps are shaded to make the range graphic. Range area was tabulated (Table 1) and shaded on maps (Fig. 2 through 10) only for those hens for which about one-half the number of roosts were known during the period in question; consequently, all acreage estimates should be considered minimal.

RESULTS

Roosting Location of Nesting Hens Tracked Systematically

Adult hen 10P7 (Fig. 2A and Table 1) was radio-instrumented on 1 February 1973; the first roost was located on 22 February, 42 days before nesting. Roost fixes obtained for the 41st, 32nd, and 25th nights before nesting are within the range used while laying (shaded in Fig. 2A) and less than one mile from the first nest site. Movement was similar before and during nesting. Her first nest was 0.2 mile from the release site; the second nest was about 2 miles east of the first nest. Two roosts were plotted during the interval between the two nesting attempts—both were in the vicinity of the first nesting range (Fig. 2A).

Adult hen 11P2 (Fig. 2B and Table 1) was radio-instrumented on 9 February 1973; the first roost was found on 22 February, 47 days before nesting. Roosts on the 47th, 46th, 40th, and 33rd nights before nesting were localized about 1.2 miles east of the range she used later while laying (shaded area in Fig. 2B) and was 1.5 miles from the nest. After the eggs were taken to an artificial incubator, only two nights elapsed before she began renesting in a new location on 26 April. She roosted both of those nights within the range used during the first laying period and renested within 0.3 miles of her first nest. The three roosts found while she was laying her second clutch were in the same range used during the first nesting period. All roosts were within an area of about 1/2 square mile from one week before laying until full term incubation of the second clutch (2 April through 4 June).

Adult hen 10P9 (Fig. 3A) was radio-instrumented on 1 March 1973; the first roost fix was obtained on 1 March, 38 days before nesting. She roosted within one mile of the capture site until four days before nesting, then moved nearly one mile east in a day. Two days later (two days before beginning to lay) she was nearly one mile farther to the east and two days after that, on 8 April, she laid her first egg 0.7 of a mile farther to the east, moving in 5 days about 2.3 miles east of the range she had used for about one month immediately after being captured. The roosting area during the laying period was about 1.5 miles long and about 0.3 mile wide (shaded area in Fig. 3A), enclosing about 210 acres (Table 1).

Adult hen 23P3 (Fig. 3B) was radio-instrumented on 19 February 1973; the first and second roosts were found on 22 and 23 February, 37 and 36 days before nesting. Both roosts were near the same place. Eight days later she roosted 1.7 miles to the west (within 0.3 mile of where she was to nest 29 days later); 15 days later she roosted over

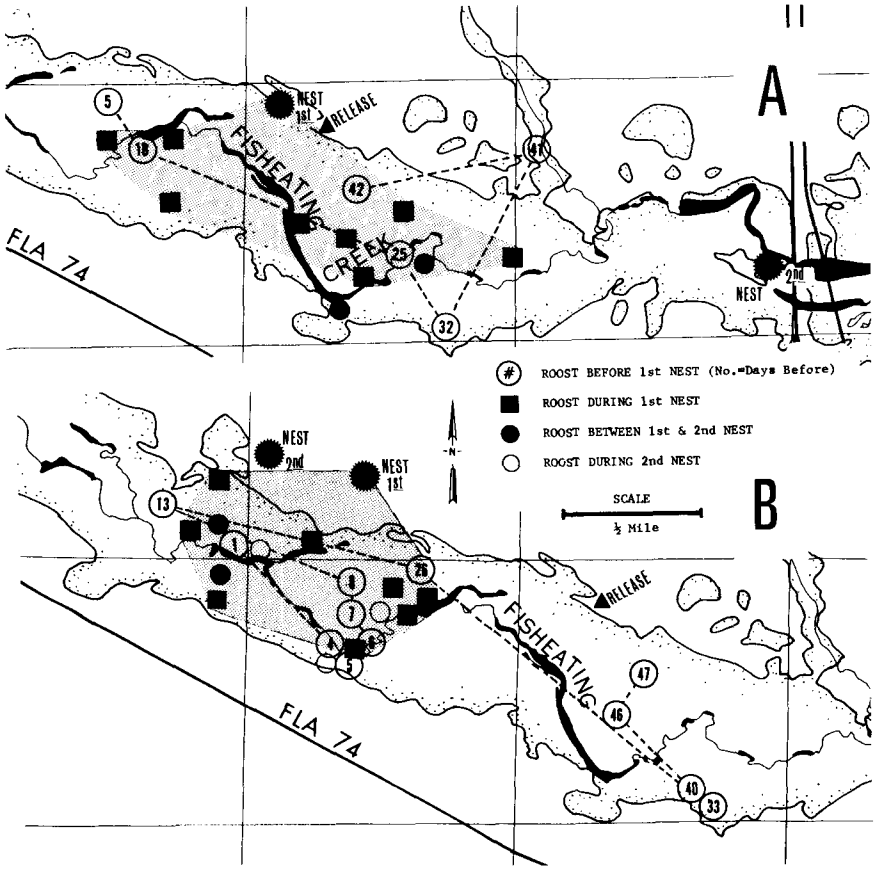


Figure 2. Release sites, nest sites, and roosts of two hens before nesting, while laying in first nest, after losing first nest, and while laying in second nest. Shaded area is range included within outermost roost sites (not including nest) while laying in the first nest. Numerals in circles show days, elapsed after roosting at that location before beginning to lay in first nest; connected broken lines show sequence. A. Adult hen 10P7. B. Adult hen 11-P2.

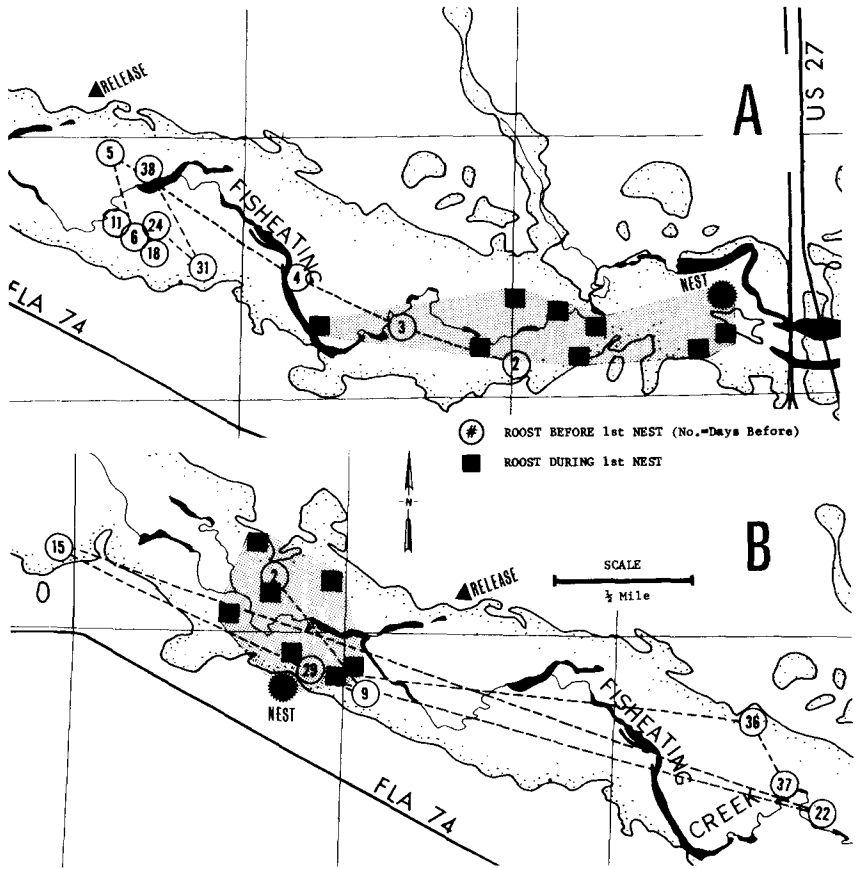


Figure 3. Release sites, nest sites, and roosts of two hens before laying and while laying. Shaded area is range included within outermost roost sites (not including nest) while laying. Numerals in circles represent days elapsed after roosting at that location before beginning to lay; connected broken lines show sequence. A. Adult hen 10P9. B. Adult hen 23P3.

Table 3. Data on laying sequences during parts of the laying periods for 5 hens in 1974, recorded by automatic telemetry.

Hen Number	Date	Age Class	Arrived at Nest (24-Hour Time) ¹	Time of Nest Departure (24-Hour Time) ¹	Egg Laid
13P2	19 Apr	Adult	1155	Unknown	11th
13P2	20 Apr	Adult	1050	Unknown	12th
13P2	21 Apr	Adult	0857	0644	13th
4P3	21 May	Adult	Unknown	1815	7th
4P3	22 May	Adult	1415	Yesterday	8th
2P5	17 Apr	Adult	1140	1710	10th
8P4	6 Apr	Adult	1346	1400	6th
8P4	7 Apr	Adult	1410	1425	7th
8P4	8 Apr	Adult	1435	Unknown	8th
8P4	9 Apr	Adult	1323	1742	9th
8P4	10 Apr	Adult	1207	2149	10th
21P2	4 May	Sub-Adult	1400	1415	4th
21P2	5 May	Sub-Adult	Unknown	Unknown	5th
21P2	6 May	Sub-Adult	Unknown	Unknown	6th
21P2	7 May	Sub-Adult	1322	1340	7th
21P2	8 May	Sub-Adult	Unknown	Unknown	8th
21P2	10 May	Sub-Adult	1320	1725	9th
21P2	11 May	Sub-Adult	1326	1628	10th
21P2	12 May	Sub-Adult	1427	Unknown	11th

¹Eastern Standard Time.

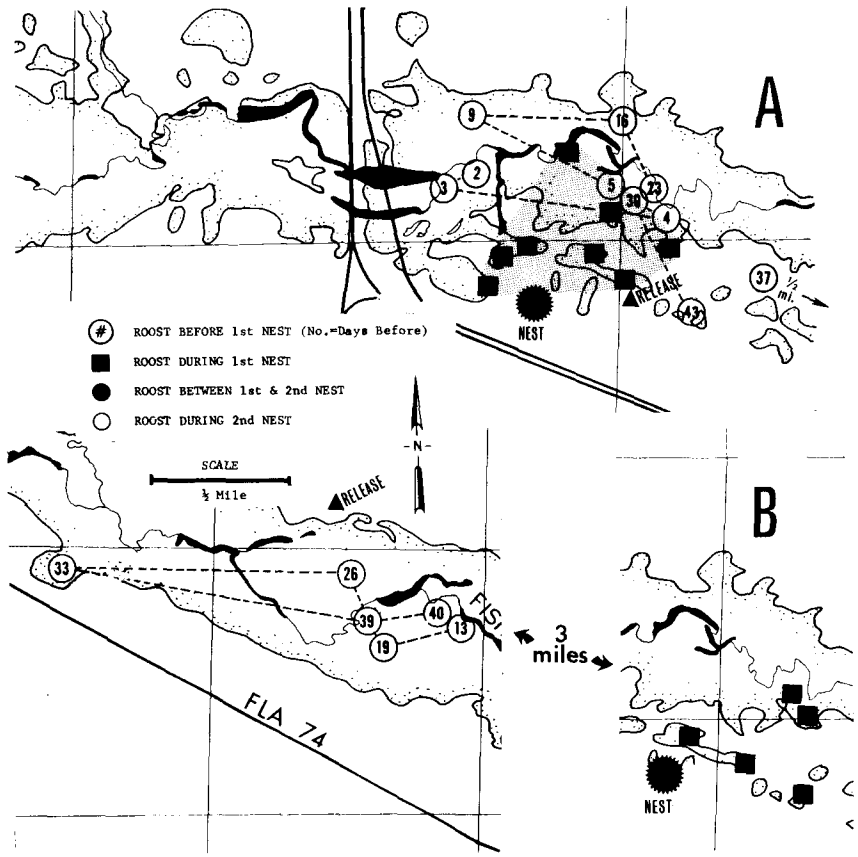


Figure 4. Release sites, nest sites, and roosts before laying and while laying. Numerals in circles represent days elapsed after roosting at that location before beginning to lay; connected broken lines show sequence. A. Adult hen 13P2. Shaded area is range included within outermost roost sites (not including nest) while laying. B. Adult hen 14P5.

one mile farther west. A roost on the 9th night before nesting was on the edge of the range that she used later while laying; the roost for the 2nd night before laying was within the range used while laying in the first nest. Of the 12 hens tracked systematically in 1973 before and during laying, this hen exhibited the greatest pre-nesting movement and the smallest laying range. Movement of hen 12M, tracked in 1969, had a similar pattern (Fig. 7). The laying range within 7 outermost radio-locations was about 140 acres (Table 1). During the 22 days before nesting, the extremes of 15 observations were 3 miles apart.

Adult hen 13P2 (Fig. 4A and Table 1) was radio-instrumented 17 February 1973; the first roost was recorded on 22 February, 43 days before nesting. Six days later she was about 0.7 mile farther west and about 1.5 miles away from the place she would later nest. From the 30th day before nesting until laying began, the roosts were within one mile of her laying range (shaded area in Fig. 4A). On 8 April she laid her first egg in a nest about 0.3 mile from the release site. The area used for roosting while nesting was about 170 acres (Table 1).

Adult hen 14P5 (Fig. 4B and Table 1) was radio-instrumented on 16 February 1973; the first roost found was on 22 February, 40 days before nesting. She roosted in the same general area for 27 days. No roosts were located during the 13 days before laying started on 3 April. The nest was about three miles east of the release site and her pre-nesting range. About one month prior to nesting, she had roosted about five miles away.

Adult hen 9P18 (Fig. 5A and Table 1) was radio-instrumented on 21 February 1973; the first roost was found on 22 February, 38 days before nesting the first time. Six pre-nesting roosts (spanning the period from 38 to 3 days before nesting) were within one mile of the first nest. Seven days after the first clutch had been collected, she laid the first egg on a second nest (on 20 April) about 0.7 mile northwest of the first nest. Seven roosts while she was laying the second clutch (shaded in Fig. 5A) indicated a small range about 0.2 square mile, within 0.5 mile of the nest. Both nests and all but one of the 21 recorded roosts from 22 February through 27 May, were inside an area of about one square mile.

Adult hen 7P9 (Fig. 5B and Table 1) was radio-instrumented 16 February 1973; the first roost fix was 51 days before nesting, about 1.5 miles east of the first nest site. Recorded movement after the 50th day before nesting was toward the eventual nesting range. Movement became more local about 13 days before laying (shaded area in Fig. 5B) confined to about 0.3 square mile. Her first clutch was taken by the investigators on 25 April. The three roosts found while she was re-nesting were in the same vicinity that she had used during the first laying period, but there are too few fixes to be very meaningful. The night before re-nesting, she roosted near a previous roost site of two months earlier, about 1.5 miles from the first nest. She began re-nesting on 1 May about 0.2 mile from the first nest.

Sub-adult hen 2P7 (Fig. 6A and Table 1) was radio-instrumented 1 February 1973; the first roost was recorded on 22 February, 43 days before nesting. By the 15th day before nesting, she had moved closer to the eventual nest site and beyond it. Radio-location on the 8th, 3rd, and last nights before nesting were closer to the nest than earlier roosts. Only four roosts were obtained during the first nesting period because investigative disturbance after the fourth egg was laid caused the hen to desert the nest, but the 10 roosts plotted during the laying of the second nest (shaded area in Fig. 6A) were within 0.5 mile of the nest and in the same vicinity as all of the radio-locations obtained during the entire nesting period. The range used during the second nest was less than one-half square mile. She did not re-nest until 30 April.

Adult hen 19P1 (Fig. 6B and Table 1) was radio-instrumented on 9 February 1973; the first roost was 7 April, 36 days before nesting. The next day she roosted 1.5 miles west within 0.2 mile of where the nest was to be. Beginning on the 35th night before nesting, all roosts plotted were within one mile of the nest site; most were much closer. Two roosts on the 13th and 21st nights after the second nest was destroyed by a predator indicated that she continued roosting within her previous range.

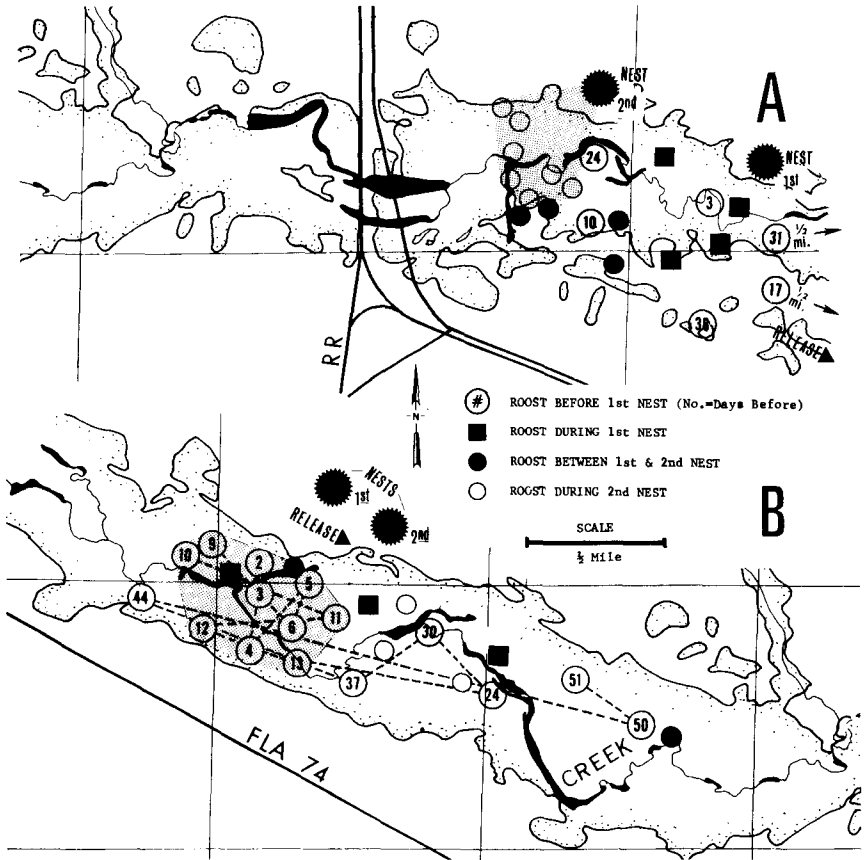


Figure 5. Release sites, nest sites, and roosts before nesting, while laying in first nest, after losing first nest, and while laying in second nest. Numerals in circles represent days elapsed after roosting at that location before beginning to lay in first nest; connected broken lines show sequence. A. Adult hen 9P18. Shaded area is range within outermost roost sites while laying in second nest. B. Adult hen 7P9. Shaded area is range within outermost roost sites (not including nest) used on 10 of the 13 nights preceding laying in first nest.

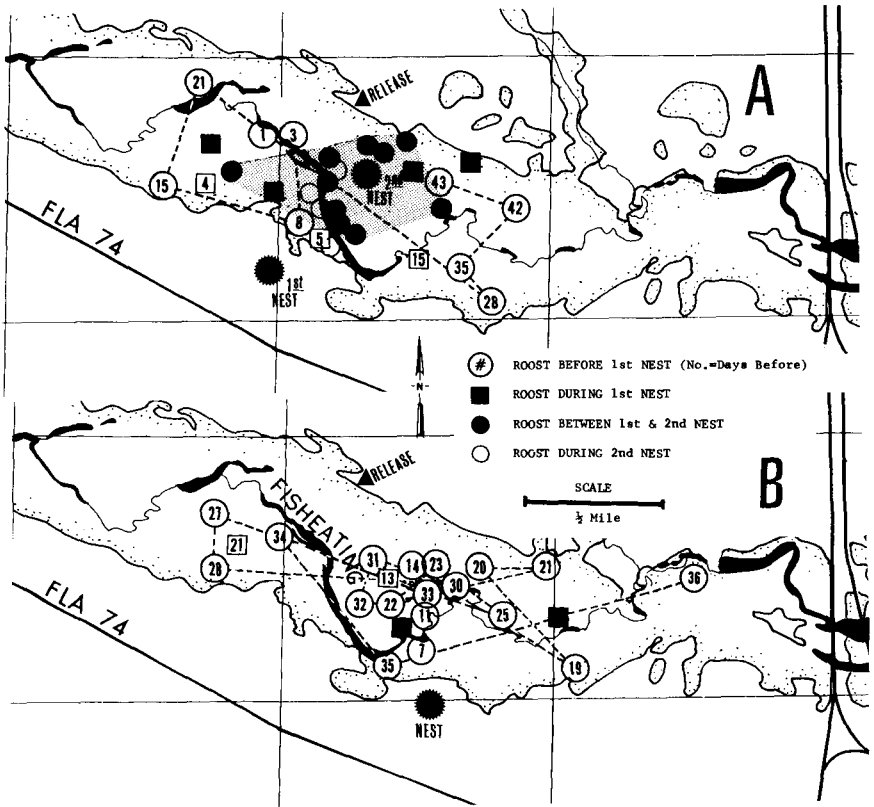


Figure 6. Release sites, nest sites, and roosts before nesting, while laying first and/or second nest, and after end of nesting attempt. Numerals in circles represent days elapsed after roosting at that location before beginning to lay. Numerals in squares represent days elapsed after end of last nesting attempt. Broken lines connect pre-nesting roost sites. Numbered squares are roost locations after the loss of the last nest (numbers enclosed represent days after nesting). A. Sub-adult hen 2P7. Shaded area is range within outermost roost sites (not including nest) while laying in second nest. B. Adult hen 19P1.

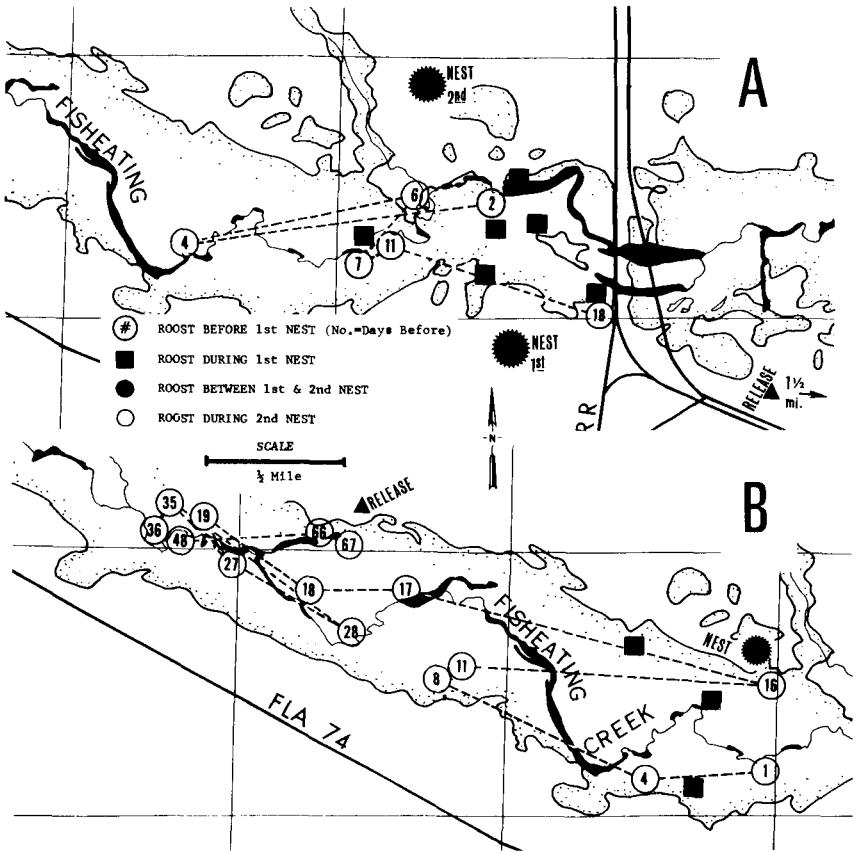


Figure 7. Release sites, nest sites, and roosts before nesting and while laying in first and/or only nest. Numerals in circles represent days elapsed after roosting at that location before beginning to lay in first and/or only nest, connected by broken lines to show sequence. A. Adult hen 16P2. B. Sub-adult hen 24P5.

Adult hen 16P2 (Fig. 7A and Table 1) was radio-instrumented on 21 February 1973; the first roost located was on 21 March, 18 days before nesting. At this time she used about the same range she used later while nesting. Too few fixes were obtained to generalize further about that. Her second nest was begun about 12 days after the first clutch had been collected on 22 April, one mile north of the first. The nesting range was about 2.5 miles west of the release site.

Sub-adult hen 24P5 (Fig. 7B and Table 1) was radio-instrumented 20 February 1973; the first roost was located on 23 February, 67 days before nesting, three days after release, and about 0.3 mile from the release site. She roosted in the vicinity of the release site and not more than one mile from it until 16 days before nesting at which time she roosted within 0.2 mile of the future nest site. She moved about a mile west and roosted there on the 11th and 8th nights before nesting. The five roosts recorded during the period immediately before nesting and through the laying period were within 0.5 mile of the nest. The nest was 1.5 miles east of the release site.

Adult hen 12M (Fig. 8 and Table 1) was radio-instrumented 2 March 1969; the first roost fix was obtained on 18 March, 17 days before nesting. She roosted within 0.2 mile of her future nest site that night, but more than two miles away the following night. The 15th night before nesting was spent near the roost of the 16th night. On the 14th night she moved about one mile toward the eventual nest site and roosted there also on the 13th night. The next roost (12th night) was 0.5 mile nearer the eventual nest site. By the 11th night, she had moved two miles farther west (a mile beyond the nest site) then, on the 10th night, roosted back about 3.2 miles to the east. The next night (9th before laying) she was about 0.5 mile back in the direction of the nest site and on the 8th night she was roosting about 0.5 mile away from the eventual nest site. She then moved over two miles to roost the 7th night before laying about 0.6 mile from the nest, but back again to the east about 2.3 miles for the 6th night. She was not plotted on the 5th night but by the 4th night before laying, she was three miles west of the 6th night's roost and about one mile beyond the nest site. The 3rd night before beginning to lay, she roosted about 1.2 miles west of the nest-site-to-be. The 2nd night before nesting was spent within 0.2 mile of the nest. The night before the first egg was laid she was about 0.9 mile from the nest. She roosted within 0.5 mile of the nest every night during the laying period (Fig. 7). This hen moved much greater distances daily than any other nesting hen we have tracked.

Movement Immediately Before Nesting

Sub-adult hen 11P and adult hen 20M were tracked for 25 and 45 days before nesting, respectively. They illustrate travel behavior that is characteristic of nesting hens. Immediately before and during the nesting period, hens often roamed in habitat where we had not found them before and they often roosted in small isolated hammocks and bay-heads where gobblers and non-nesting hens rarely ventured and almost never roosted. The 10 northern-most roosts used by hen 11P (Fig. 9A) before nesting were along a small creek strand less than 0.2 mile wide bordered by good nesting habitat. Turkeys were rarely known to roost there except for a few hens during the laying season. Hen 20M used a range of less than 1/2 square mile for roosting except one night that she went 1.5 miles north of the creek swamp (her usual range) to roost in a small live oak (*Quercus virginiana*) and cabbage palm (*Sabal palmetto*) hammock. She had returned to her usual range by the next night and eventually nested 0.5 mile south of her previous roosting range (Fig. 9B).

Daytime Movement and Roosting Range While Laying

Figure 10 shows the mapped range used by sub-adult hens 5P6 and 23P6 while laying in April 1971. The two nests were about 400 feet apart. Their laying and incubating periods overlapped, but did not coincide exactly. The two hens were not known to be together at any time during their nesting periods. These circumstances permit a comparison of the movement behavior of two different hens in the same habitat at the same time.

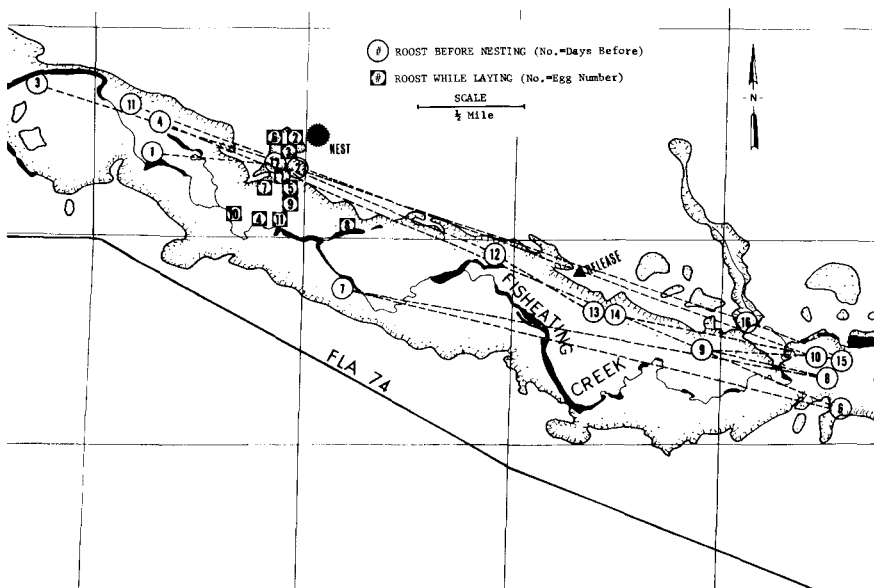


Figure 8. Roosting places before and during laying period for adult hen 12M. Released 2 March 1969, 8 miles west of capture site; 27 of the 29 roosts are plotted from 18 March through the first day of incubation on 16 April. Broken lines connect roost fixes before nesting in sequence.

In calculating the roosting range area for hen 23P6, we disregarded two cases of erratic movement. On the fourth day of laying, the day after laying her third egg, 23P6 moved about 0.5 mile in one hour then only 0.1 mile during the next two hours. Two hours later she moved another 0.3 mile farther from the nest but returned to one of her regular roosting places nearly one mile distance in about one hour. She did not visit her nest that day. Another time the same hen moved more than 0.2 mile outside her usual range and returned within two hours, never to be found in that vicinity again. These jaunts are plotted in Figure 10, but they are not shaded as nesting range. No erratic movement was observed for hen 5P6.

The range while nesting was similar for the two sub-adult hens—150 acres for 5P6 and 120 acres for 23P6, with 23P6 overlapping 70 percent of 5P6's range and 5P6 overlapping about 60 percent of 23P6's range. The entire ranges of both were in cypress woods. The large grassy openings, readily available outside the woods, were not used. Both hens tended to roost in the western part of their ranges; 5P6 were especially prone to this. Our observations of many nesting hens suggest that localized roosting is not the rule, but we have not attempted to compare roosting ranges with total range used. Total range used during the day and at night will be greater than night roosting range alone, but we have not attempted to compare the two nor to measure individual variation among hens in their roosting behavior.

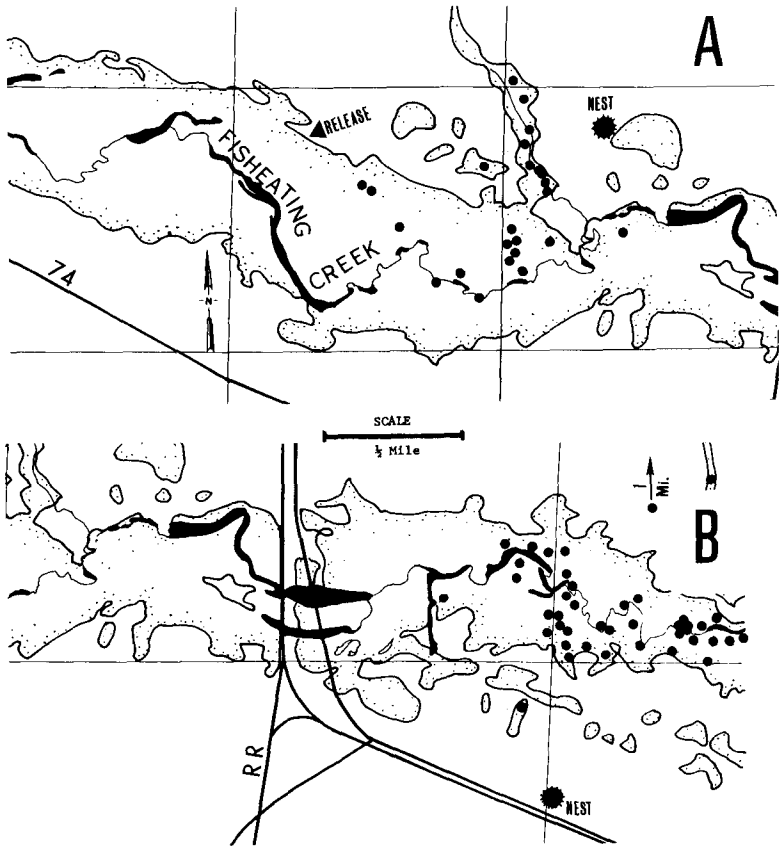


Figure 9. Roosts and nest sites of two hens before and during the laying period. A. Sub-adult hen 11P, 24 radio-locations during the 25-day tracking period. B. Adult hen 20M, 42 radio-locations during the 45-day tracking period.

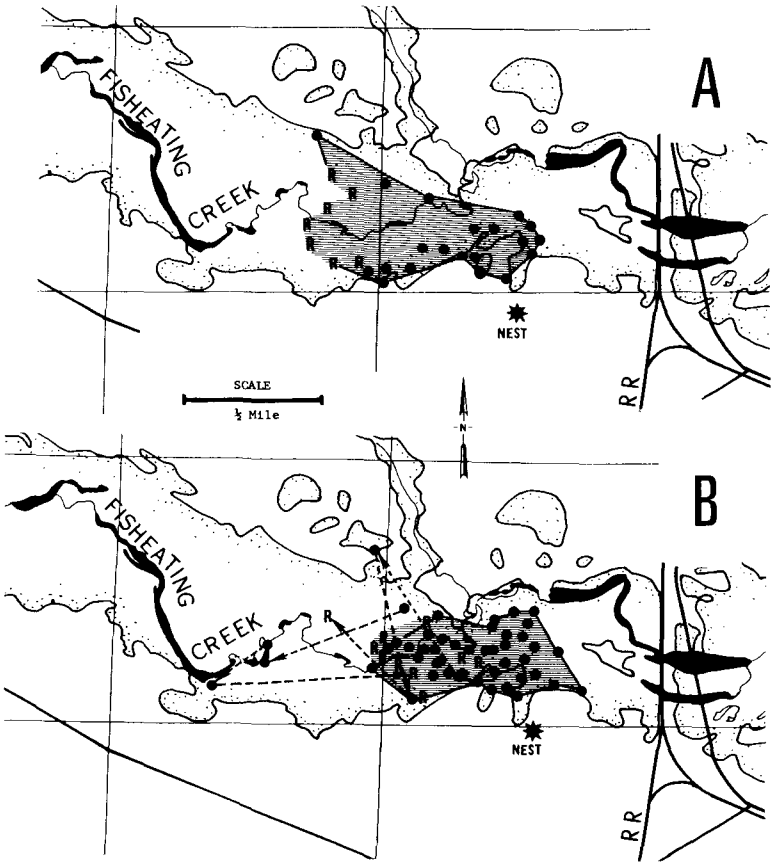


Figure 10. Movement and range of two sub-adult hens during the laying period. Shaded area includes range within the outermost daytime positions connected to exclude land areas outside woods which were known to be not used by these turkeys during the tracking period. A. Hen 5P6, 15-23 April 1971. B. Hen 23P6, 9-20 April 1971.

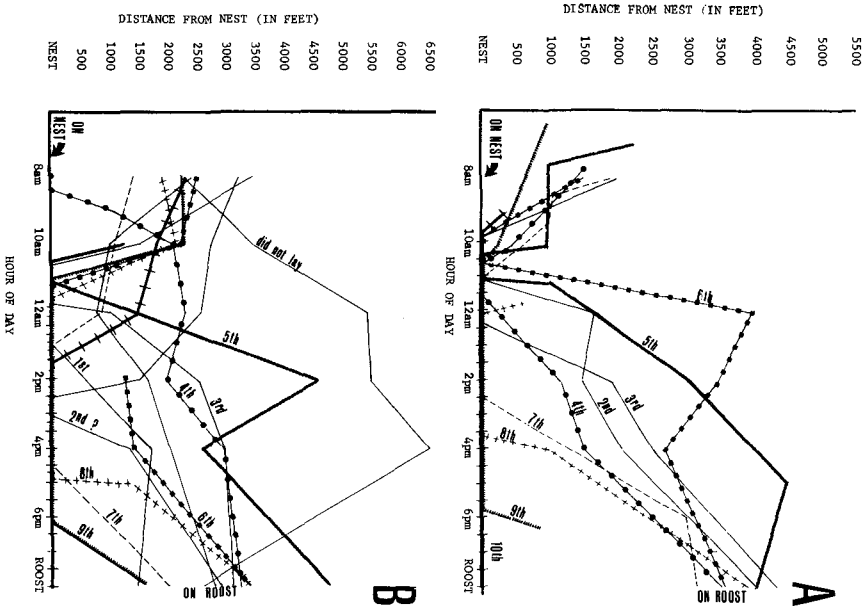


Figure 11. Time at nest and distances from nest bi-hourly during the laying period. Symbols used for lines distinguish lines where they cross; the number on each line is the sequence of the egg laid. A. Hen 5P6, 15-23 April, beginning with the second egg laid. B. Hen 23P6, 9-20 April beginning with first egg laid and showing a day that no egg was laid between the first and second eggs.

Figure 11 shows the time that hens 5P6 and 23P6 visited their nests each day, the length of visitation as each egg was laid, the time of leaving after each visit, and distances from their nests at bi-hourly intervals during the day. Both hens usually came to their nests to lay just before noon and their morning movement from the roost was generally toward the nest. While laying the first one-half of their clutches, the two hens usually remained at the nest for about an hour or less (but began to stay longer with each egg laid after the 6th). After leaving the nest, movement was generally away from the nest throughout the afternoon to a distance of about 4,000 feet (hen 5P6) and 3,000 feet (hen 23P6) to roost.

Nest Attentiveness

Nest visitation was observed at 8 nests by an automatic recorder (Table 2). The hens left their nests during the period of continuous incubating once every 1.86 days, on the average. The mean length of time off the nest was 117.2 minutes (1.95 hours) and ranged from three to 937 minutes (15.62 hours). The hen that left one time for only three minutes stayed off for 786 minutes (13.10 hours) on another occasion.

Nest-leaving was more frequent in morning than afternoon. Of 105 observations made, only 14 times were hens absent during noon. Absence from the nest after noon was usually late in the day (Tables 2 through 9). This substantiates our earlier impressions (Williams et al 1972) that were based on less data. This does not correspond to reports by Blakey (1937) and Hillestad and Speake (1971) who report that they observed hens leaving their nests at mid-day, unless they considered late morning to be mid-day.

Nest Attendance of Infertile Eggs

Five hens exhibited incubating behavior with whole clutches of infertile eggs. They terminated incubation behavior after 26, 29, 35, 64 days, and after an undetermined period (for one hen). It is difficult to explain desertion on the 26th and 29th days of incubation in view of the fact that the "normal" period of hatching is 26 to 28 days. We suspect that time is only one of several factors determining the maximum duration of incubating behavior and that the sounds and vibrations emanating from the developing embryo during late incubation have an important role in late incubating behavior.

DISCUSSION

The movement observed in our study from winter range to nest site was much smaller than has been reported for *M. g. merriami* (Ligon 1946) or *M. g. intermedia* (Glazner 1967 and Thomas et al 1973). Our hens exhibited movement very similar to *M. g. silvestris* reported in one Alabama study (Hillestad 1973) but moved much less than other reports for *M. g. silvestris* (Ellis and Lewis 1967 and D. W. Speake 1974, personal communication) but most of the data available for *M. g. silvestris* are not comparable to our data in terms of distance from winter to nesting range.

We see two explanations for smaller range utilization in our study, both of which have potential management applications. First, our turkeys did not often range farther than about 100 yards from cypress woods and not even that far except when they nested in the ecotone between the expansive saw palmetto prairies and the grassy glades. This barrier effect of saw palmetto prairies restricted movement north and south and produced elongate east-west range patterns oriented along Fisheating Creek. From a management standpoint, the non-forested range cannot be managed effectively for turkeys without drastic transformation into woodland conditions. It should probably be managed for other wildlife.

Secondly, movement was minimized by the nearly ideal composition, size, and spacial relationship (juxtaposition) of the habitat types in the study area. A small net movement to the west (0.20 miles) from winter to nesting range was noted (Table 1) with seven of the hens shifting westward, two not shifting at all, and three shifting to the east. Some of the hens that moved to the west to nest did so after leaving habitat that other hens shifted eastward to nest in. Some of both groups that shifted range to nest left habitat that other hens remained in to nest. The same pattern has been observed in many additional hens. This suggests that movement in our study was not necessitated by the distances separating suitable nesting habitat from winter habitat, but was probably a reflection of the innate movement characteristics of the animal. The management importance of this is that there may be a minimum amount of movement that will be exhibited by turkeys and that it may not be possible to curtail it by habitat manipulations. This would be the theoretical "minimum management unit" for the species. We have presented data which provide an estimate of 200 to 500 acres for this movement during the period of late winter through the nesting season. The year-round range requirements on the study area must await more complete analysis of movement data collected at other seasons (unpublished). Knowing the minimum size of management units for turkeys will be increasingly more important as urbanization, sub-urbanization, agriculture, highway construction, and forestry continue to eat away at turkey habitat, especially in Florida and along the upper Gulf and lower Atlantic coasts.

Between late winter and early summer, turkeys on our study area did not use the grassy zone that lies outside of and parallel to the creek and its associated cypress woods. This would appear to be at variance with other studies (i.e. Hillestad and Speake 1971) which assign considerable importance to "openings" in turkey habitat. To the contrary, we believe the seeming contradiction is due to differences in the nature of cypress woods *versus* other turkey-inhabited woodland situations in the eastern United States. The cypress woods in our study area exist in varying stand densities, portions of which permit ample sunlight penetration through the overstory for good

growth of ground covering grasses and forbs. Thus, large openings on our study area offer little to the turkeys that cannot be found within the woods. Throughout most of the range of *M. g. silvestris*, however, ground cover is sparse inside the woods and very little summer food or cover for very small poults is produced there. Openings in such places provide a vastly different habitat situation that are greatly used by turkeys. (We suspect that turkeys will tend to remain in or very near forest cover anytime that they find preferred foods there.)

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