NESTING, BROOD RANGE, AND REPRODUCTIVE SUCCESS OF AN INSULAR TURKEY POPULATION

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Abstract: A study of nesting and brood rearing in a coastal island wild turkey (*Meleagris gallopavo*) population was conducted in Georgia from 1975 through 1977. Thirty-nine hens were instrumented during the 3 years. Pre-nesting movements and nesting ranges were determined for 9 hens in 1977. Average maximum straight-line movement for the 9 was 4.60 km; movements from release sites to nests averaged 2.38 km. Twenty-seven of the hens were known to nest. Twenty-two nests were located by telemetry fixes on incubating hens and 1 nest was found incidentally. Fourteen hens selected similar nest sites in saw palmetto (*Serenoa repens*) dominated habitat. Two others nested in similar forest type under clumps of perennial vegetation. Four nests were located in oak-pine forest and 3 others were found in open situations. Predators destroyed 6 nests; 1 was abandoned for unknown reasons. Nest clustering appeared to be influenced by both habitat selection and sociological factors. Hens nesting in saw palmetto showed strong preference for locating near burned areas. Preference was also demonstrated for nesting in close proximity to firebreaks and game trails. Fifteen telemetered broods were tracked. Most broods hatching in saw palmetto habitat roosted their first night in saw palmetto then moved into heavily forested areas. Extensive movements were recorded for most broods at some time during the first 5 days. Older broods showed strong preference for old field situations. Early poult mortality occurred during the study period with an average observed survival of 1.7 poults per successfully nesting hen.

Proc. Ann. Conf. S.E. Assoc. Fish & Wildl. Agencies 32: 137-149

Wild turkeys were established on Sapelo Island between 1970 and 1973 as a source of stock for a restoration program. Observations during the fall of 1974 indicated a possible population decline. A 3 year investigation was initiated in January 1975 to determine: (1) the size and structure of the turkey population, (2) habitat used for nesting and brood rearing, and (3) the role of predators in nesting success.

We thank biologists L. E. Williams, Jr. and L. H. Barwick for helpful suggestions and for loaning us telemetry equipment during part of the first year. R. Simpson aided with some of the field work as did C. Marshall and his students at Abraham Baldwin Agricultural College. Aircraft pilots B. Vaughn and M. Harris assisted with locating turkeys. We are grateful to J. R. Bozeman for aid in plant identification and helpful suggestions. Appreciation is expressed to B. Howarth, Jr. for determination of embryonic development for some eggs. G. D. Stephens generously assisted in reproducing figures for the manuscript. Financial support was furnished by a contribution of the Federal Aid to Wildlife Restoration Program, Georgia Pittman-Robertson Project W-37-R.

STUDY AREA

The study area is a 4,410 ha barrier island on the Georgia coast in McIntosh County, most of which is owned by the Georgia Department of Natural Resources and managed as the R. J. Reynolds Wildlife Refuge. A small community and facilities for the University of Georgia Marine Institute are located on the island's south end. The coastal setting has a

moderating effect on seasonal temperatores. Brunswick, 32 km south of Sapelo, normally has 305 freeze-free days annually. Average annual rainfall is about 134 cm, with half that amount falling from June through September (Johnson et al. 1974).

Seven plant communities can be identified; areas occupied by these associations are shown in Fig. 1. Hillestad et al. (1975) described plant communities occurring on Cumberland Island, GA. Hardwood-dominated communities on Sapelo closely resemble those of Cumberland, while pine-dominated forest types exhibit greater dissimilarities.

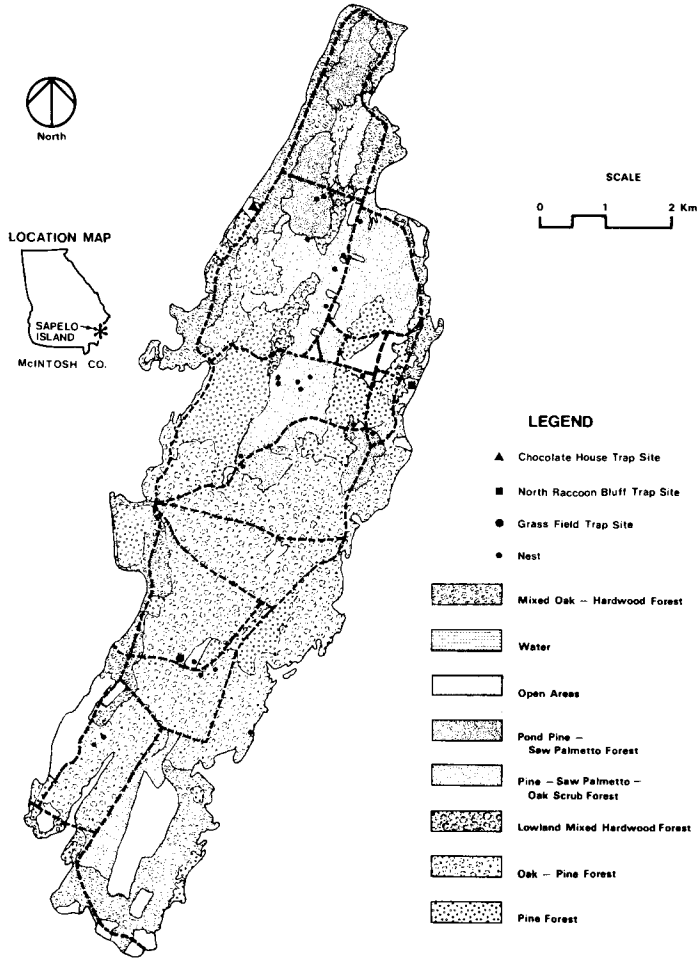

Fig. 1. Map of Sapelo Island showing major habitat types, capture and release sites, and 23 nest sites.

Pine-sawpalmetto-oak scrub forest,—At highest elevations (near 4.9 m) in this community, longleaf pine (*Pinus palustris*), slash pine (*P. elliottii*), and sand live oak (Quercus *virginiana* var. *maritima*) form a scattered overstory above a scrubby growth of small oaks (juvenile sand live oak, *Q. chapmanii*, and *Q. myrtifolia*), saw palmetto, and

staggerbush (*Lyonia ferruginea*). Slash pine attains dominance over longleaf at slightly lower elevations and pond pine (*P. serotina*) appears in the overstory. Saw palmetto, heath species, small oaks, and other broad-leaved evergreens comprise the understory.

Pond pine - saw palmetto forest. – Pond pine assumes almost total overstory dominance on some poorly drained sites. Saw palmetto expanses (to 2.1 m) thrive in this community and staggerbush reaches small tree stature. Red bay (*Persea borbonia*) and wax myrtle (*Myrica cerifera*) are also common in the understory.

Pine forest. – This association occurs on very poorly drained soils between the rim of mixed oak-hardwoods and the island's elevated center. The overstory is dominated by loblolly pine (*P. taeda*) and slash pine in uneven age stands. Ground cover is largely maiden cane (*Panicum hemitomon*), panic grasses (*Panicum* spp.), and other herb species. Numberous open grass ponds (predominantly maiden cane) varying from 0.4 to over 4 ha occur, mainly along old ditch systems.

Oak - pine forest. – This association comprises the largest percentage of upland acreage on the island. Slash pine and loblolly pine along with live oak (*Q. virginiana*) and laurel oak (*Q. laurifolia*) dominate the overstory. Common understory shrubs occurring with clumps of saw palmetto include wax myrtle, red bay, staggerbush, yaupon (*Ilex vomitoria*), and sparkleberry (*Vaccinium arboreum*).

Mixed oak - hardwood forest. – This most advanced of forest types occurs on moderately well drained soils along the island perimeter. Characteristic tree species are live oak, laurel oak, American holly (*Ilex opaca*), magnolia (*Magnolia grandiflora*), loblolly pine and slash pine. Common understory species include red bay, saw palmetto, sparkleberry, grape (*Vitis* spp.), and spike grass (*Uniola sessliflora*).

Lowland mixed hardwood forest. – A small amount of this community occupies a natural drainageway on the north end. Blackgum (*Nyssa biflora*), red maple (*Acer rubrum*), red bay, laurel oak, water oak (*Q. nigra*), and pond pine are dominant tree species. Wax myrtle, saw palmetto, fetterbush (*Lyonia lucida*), and vines (grape and *Smilax* spp.) occur in the understory.

Open areas and miscellaneous. – Fields occur as a result of past farming and cattle operations or recent management activities. On the refuge old fields have been maintained by annual burning, mowing, and planting some areas in rye (*Secale cereale*)(24 ha), bahia grass (*Paspalum notatum*)(20 ha), and chufa (*Cyperus esculentus*) (2 ha).

From 1970 to 1973, 39 wild turkeys were stocked, including 20 hens, 9 gobblers, and 5 unsexed juveniles of *M. g. silvestris*, and 4 hens and 1 gobbler of M. *g. osceola* from Lykes Brothers Fisheating Creek Wildlife Management Area in Florida. Situated on an island, the turkey population has probably experienced no immigration; a few have been removed by trapping; poaching has been minimal.

Baiting operations in connection with this study and relocation activities have provided turkeys with several thousand pounds of shelled corn (*Zea mays*) each year. A large deer (*Odocoileus virginianus*) herd has competed with turkeys for corn at bait sites. During the study, hunters removed from 113 to 403 raccoons (*Procyon lotor*) and a small number of opossums (*Didelphis virginiana*) annually. No other wild carnivores were present on upland sites, although feral dogs and house cats were occasionally observed.

Population Estimates

Estimates of pre-nesting populations were obtained from observations of turkeys at 5 established bait sites and other locations between January and April of each year. Counts revealed pre-nesting hen populations of 28, 26, and 48 birds for the 3 years. These estimates do not include 1 hen which died in 1976 during drug trapping, or 7 hens captured in 1977. Two of these birds died during trapping and the other 5 were removed for restocking.

METHODS

From 1975 through 1977, 39 hens were captured and instrumented in February, March, or April. Most were captured with tribromoethanol (Williams et al. 1973); 3 were captured with a rocket net. All birds were banded with aluminum leg bands and some were marked with patagial tags.

Tracking transmitters were mercury powered, pulsed-signal units transmitting between 150.850 MHz and 151.450 MHz. Transmitting units were assembled using 2 batteries wrapped to the transmitter with fiberglass filament tape. Latex surgical tubing straps were attached with tape and the entire unit was dipped in a waterproofing compound. Transmitters used in 1977 were prepared by adding a small spring to the antenna base and sealing batteries in dental acrylic. Weights of transmitting packages ranged from 113 to 130 g. During the study contact was lost with 4 instrumented hens soon after they were released; 1 other unit ceased transmitting within 45 days. Reception life of other units was at least 4 months. Reception range varied from 180 m to over 1.6 km. Two portale 24-channel continuous tuning receivers and one 12-channel crystal controlled receiver were used. Hand-held, 3-element yagi antennas and a jeep-mounted 5-element high-gain antenna were used for obtaining location fixes. In a few instances a Bell helicopter was used for locating instrumented birds.

Daytime position fixes were made by locating an instrumented hen with telemetry and approaching close enough on foot to identify the location. Notes describing each location by distance and direction to nearby landmarks and vegetation type were recorded in field notebooks. Reproduced copies of quadrangle maps and field sketches were also used for recording locations. Roost fixes were determined by triangulation using the jeep-mounted antenna and a system of listening posts, or by approaching the roost site with hand-held antenna. Tracking data were compiled in separate logs for each hen. For analysis, location fixes were transferred to an aerial photo mosiac of the study area, or to quadrangle maps, from which outline tracings showing locations were prepared. Ranges for various time periods were determined by connecting outermost locations (Ellis and Lewis 1967) and calculating acreages with a compensating polar planimeter. All movements of hens and broods were determined by straight-line distances between points or successive telemetry fixes.

Information on 15 telemetered broods is included in this paper. Five were tracked at 1-hour intervals during the first partial or full day after leaving their nests (poults were considered 1 day old during the day of leaving the nest), bi-hourly the second day, and at noon, mid-afternoon and roost during the remainder of the first 2 weeks. Thereafter, locations were made at noon and roost on most days and occasionally at other times until the broods were at least 1 month old. Two other hens were tracked until it was determined that their broods had been lost at 7 and 15 days. One brood was tracked systematically from hatching to 17 days and from 28 days to over 3 months. Limited tracking data were obtained for 7 other broods during the study.

RESULTS AND DISCUSSION

Pre-nesting Movements and Range

Movements of 7 subadult and 2 adult hens instrumented in 1977 were monitored sufficiently during the pre-nesting period to determine dispersal from capture sites and minimum ranges prior to incubation. Data on these hens are included in Table 1. Hens 179, 715, 716, and 717, captured together at the North Raccoon Bluff (NRB) trap site, were released March 9. Twelve days later they had moved 2.86 km southwest to an area of a large freshwater marsh. In 1 week the group then moved 3.46 km north to occupy overlapping nesting ranges of 145, 177, 172, and 132 ha. Average distance between extreme locations for the 4 was 5.73 km. Hen 717 ceased incubation April 27, her nest presumably having been depredated before the nest site was located. The vicinity of this nest was 228 m from the nests of hen 179 and 716, which were 213 m apart. The nest of hen

715 was located 0.61 km east of that of hen 716. Nesting chronology of these hens was similar with incubation periods of the 4 beginning from April 25 to 28.

Table 1. Tracking information for 10 adult and 12 subadult hens on Sapelo Island, GA, 1975-1977.

Band No.	*Age Class*	*Trap[a] Location*	*Release Date*	*Distance From Trap Site to Nest (km)*	*Tracking[b] Period (Days)*	*Days[c] Tracked*
1975						
160	Adult	NRB	Mar. 21	1.75	100	17
161	Adult	NRB	Mar. 21	1.63	64	11
163	Subadult	NRB	Mar. 21	5.91	45	6
164	Subadult	NRB	Mar. 21	1.88	75	13
1976						
164	Adult	NRB	Mar. 23	0.84	120	65
169	Subadult	NRB	Feb. 15	2.90	159	79
171	Subadult	NRB	Feb. 15	2.32	151	62
172	Subadult	NRB	Feb. 15	2.25	100	28
173	Subadult	NRB	Feb. 15	2.11	72	24
176	Adult	NRB	Feb. 15	2.04	148	86
177	Adult	CH	Mar. 11	1.82	74	21
178	Adult	NRB	Mar. 23	1.08	93	24
1977						
179	Subadult	NRB	Mar. 9	3.25	99	37
502	Subadult	GF	Feb. 28	1.85	96	48
505	Adult	GF	Feb. 28	2.11	94	52
506	Adult	GF	Feb. 28	1.59	96	48
508	Subadult	GF	Feb. 28	2.72	109	33
510	Subadult	GF	Feb. 28	0.84	77	37
714	Subadult	NRB	Mar. 9	0.79	125	48
715	Subadult	NRB	Mar. 9	2.67	93	47
716	Subadult	NRB	Mar. 9	3.19	99	41
718	Adult	NRB	Mar. 9	2.99	92	47

[a]Abbreviation: NRB - North Raccoon Bluf; CH - Chocolate House; GF - Grass Field.
[b]From day instrumented through date last heard.
[c]Different days in which at least one fix was obtained.

Hen 718, captured at NRB March 9, left the release site on March 15. Six days later she had moved 5.49 km south to the vicinity of Grass Field (GF) trap site. Radio tracking during this period revealed that she moved through the area of her future nest site. By March 26, she had returned to the NRB area where she remained for 8 days. Subadult hen 508 remained near GF trap site for 17 days following her release on February 28, then traveled 5.31 km north and assumed localized movement near NRB trap site on March 22. During dispersal she was located once with hen 718, on March 19. Both hens were again found together after hen 718 returned to the NRB area and on April 2 they moved 3.17 km southwest together to occupy overlapping nesting ranges of 125 ha (718) and 107 ha (508). The 2 roosted and fed together often until hen 508 began incubation April 18. Their nests were 274 m apart.

Hen 502, captured at GF trap site, initially moved north 1.60 km then moved an extreme distance of 3.52 km southeast by April 6. She assumed a nesting range of 91 ha on the edge of the saltmarsh.

Two hens exhibited little movement to their nesting ranges. The nesting range of hen 506 comprised 82 ha 0.29 km from the GF release site. Extreme distance for this bird was 1.74 km. Hen 714 assumed a nesting range of 123 ha associated with an old field system and her release site at NRB. Movements of her brood were confined to this area during 1 month of tracking.

Although insufficient data are available to plot pre-nesting movements for other turkeys, the spring "shuffle" demonstrated by 7 of the 9 hens tracked was evident in each of the 3 years. These movements are not totally reflected in dispersal distances to nests presented in Table 1. Average extreme distance for the 9 was 4.60 km as compared to an average release to nest dispersal of 2.38 km. Movements observed in our study compare closely with those presented by Williams et al. (1975). Average release to nest dispersal (2.25 km) was considerably smaller than average extreme distance (about 3.9 km) in that study. Those authors suggested that movements of hens were not necessitated by distances separating winter range and nesting habitat, but were probably indicative of basic attributes of turkeys. Hillestad (1973) reported relatively small release to nest (1.29 km) and extreme distance (2.74 km) values for turkeys in Alabama.

Nesting Frequency

Twenty-seven (69%) of 39 hens instrumented during the study were known to nest. Twenty-two nests were located by fixes on incubating hens. Two hens abandoned their nests for unknown reasons shortly after incubation began, before exact nest locations were determined. Three hens with which radio contact had been lost were observed with broods, confirming nesting had occurred.

Of the 12 hens not known to nest, 9 (4 subadults and 5 adults) were radio tracked throughout the nesting season. Several of the 9 exhibited typical nesting behavior and it is likely their nests were destroyed during laying, before locations were determined. The transmitting units of 2 hens failed shortly after release and no information was gathered for them. One subadult hen died about 6 weeks after her release; she was not known to have nested.

Nest Site Characteristics

Twenty-three nests were located, including 1 depredated nest of an uninstrumented hen which was found accidentally. Twelve nests were in the pine-saw palmetto-oak scrub community, 4 were in pond pine-saw palmetto habitat, 4 were in oak-pine forest, and 3 were in old fields (Figure 1).

Saw palmetto was the preferred nest cover for hens released from the NRB and Chocolate House (CH) sites. Of 17 hens from these sites whose nests were located, 11 selected pine-saw palmetto-oak scrub and 4 chose pond pine-saw palmetto habitat. One additional hen, released from the GF site, nested in pine-saw palmetto-oak scrub habitat. Ten of the 12 nests in the pine-saw palmetto-oak scrub community and 2 located in pond pine-saw palmetto habitat were found in saw palmetto 0.9 to 1.2 m in height under scattered, light pine stands. Shrubby species commonly found within 1.5 m of the nests included sand live oak, staggerbush, *L. fruticosa*, red bay and wax myrtle. Overhead concealment by saw palmetto and the other species ranged from 50 to 90 percent. The 2 pine-saw palmetto-oak scrub nests not in saw palmetto were concealed in clumps of gallberry (*Illex glabra*) and wax myrtle. All were at least partially surrounded by lower vegetation (0.3-0.6 m), primarily dwarf blueberry (*Vaccinium myrsinites*), low bush huckleberry (*Gaylussacia frondosa* var. *tomentosa*), dwarf live oak (*Q. v. var. minima*) and bracken fern (*Pteridium aquilinum*). The remaining 2 nests in pond pine-saw palmetto habitat were partially concealed beneath saw palmetto and red bay. Williams et al. (1972) found a high degree of selection (over 80%) by nesting turkeys for an easily

recognizable cover type dominated by saw palmetto on their south Florida study area at Fisheating Creek. By comparison, the pine-saw palmetto-oak scrub community fairly closely resembled the Fisheating Creek area in plant species composition. Two conspicuous differences were the scarcity of pines on the Florida site and absence of wire grass (*Aristida stricta*) on Sapelo.

Three hens released from the GF trap site in 1977 and 1 released from the NRB site in 1975 nested in relatively open understory in oak-pine forest. Yaupon was common near all of the nests and grape vines (*Vitis* sp.) were present at 3 of the sites. Very little lateral concealment was evident for 3 of the nests.

Three nests, including 2 of hens released at NRB and GF trap sites, and 1 found accidentally, were on the edges of old fields. Two were partially concealed beneath sand cordgrass (*Spartina bakeri*). The third was in a small wax myrtle clump. Wax myrtle was also found within 1.5 m of the other 2 sites.

The presence of burned areas appeared to be an important consideration of nest site selection in saw palmetto dominated habitats. Of the 16 nests located in pine-saw palmetto-oak scrub and pond pine-saw palmetto communities, 9 were near areas burned the preceding winter and 7 others were located in areas burned 1 year prior to nesting (Table 2). Four of the current-year burn nests were in small unburned clumps surrounded by freshly burned areas. The remaining 5 were from 8 to 38 m from newly burned vegetation. Effects of burning were evident near the 7 nests located in 1-year burn areas. Burned and regenerating red bay and wax myrtle clumps were used as concealment by 6 of these hens. A 68 ha portion of pine-saw palmetto-oak scrub habitat on the south end of the island has not been burned for 15 to 20 years. No nesting was observed in this area although several instrumented hens nested in surrounding areas and their broods utilized adjacent old fields.

Table 2. Turkey nest placement in relation to habitat types and burning activities, 1975-77, on Sapelo Island, GA.

		Burning[a]											
		1975				*1976*				*1977*			
		Percent	*No. Nests*			*Percent*	*No. Nests*			*Percent*	*No. Nests*		
Habitat Type	*Area (ha)*	*Burned*	*0*[b]	*1*	*X*	*Burned*	*0*	*1*	*X*	*Burned*	*0*	*1*	*X*
Pine-saw palmetto-oak scrub	673	26	3			29	2	4		21	2	1	
Pond pine-saw palmetto	250	0				44	2			22		2	
Pine	576	52				65				36			
Oak-pine	1609	5			1	40				10	1		2
Mixed oak-hardwood	753	1				10				0			
Lowland mixed hardwood	83	7				0				38			
Old field	415	9			1	29				10	1	1	

[a]Burning operations conducted from November-February each year.

[b]Time period since portion of habitat in vicinity of nest was burned: 0 - preceding winter; 1 - 1 year prior to nesting; X - unburned in recent years.

Three other nests were near recently burned habitat. One oak-pine forest nest was 7.6 m from an area burned 1 month prior to nesting. One nest located on the edge of a small field was within 40 m of a fresh burn, while a second old field nest site was in an area burned the previous year.

Stoddard (1963) stressed the importance of controlled fire in managing southeastern coastal plain turkey populations. His recommendation of "spot burning" one third to half the woodland acreage on a tract annually seems pertinent to turkey nest site selection on Sapelo.

Hens demonstrated a preference for nesting near game trails and firebreaks, presumably to faciitate movements to and from their nests. Five nests were within 1.8 m of well defined game trails. Seven others were within 14 m of established firebreaks. Close proximity to these paths may have made nests more susceptible to predation. The 5 depredated nests of instrumented hens were each within 15 m of a firebreak. During the

study raccoons were often observed to use firebreaks as travel ways and escape routes through thick vegetation.

Nest placement of some hens appeared to be influenced by social factors as well as habitat. In 1975 adult hens 160 and 161 were captured together at NRB trap site and later nested 274 m apart in pine-saw palmetto-oak scrub habitat. Hatch dates indicated the 2 established their nests at about the same time. Subadult hen 164, captured at NRB trap site with the other 2 hens, began incubation of a nest 119 m from hen 160 about 2 weeks after the others. Adult hens 173 and 176, instrumented in 1976, were observed together during the pre-nesting period and nested 77 m apart. Their broods hatched 4 days apart. From the previous discussion of pre-nesting movements of 1977 instrumented hens it is clear that social factors were important in the eventual close proximity of nests for several groups of hens. Hillestad (1973) reported similar social groups eventually leading to clustering of nests in Alabama.

Fifteen of 16 nests measured had obvious depressions. Average dimensions for nests were 4.6x23.9x27.4 cm. Similar nest sizes have been reported by Williams et al. (1969) and Hillestad (1973). Eighteen nests had clutches of 4 to 16 eggs with an average of 10.1 (Table 3). Thirteen full-term nests contained a total of 129 eggs. Of these, 111 (86%) hatched successfully. Two clutches contained 4 and 5 eggs when they were examined after

Table 3. Nesting data for 22 turkey hens on Sapelo Island, GA, 1975-1977.

Band No.	*Clutch[a] Size*	*Number Eggs Unhatched*	*Size Of Nest (cm)*	*Date End Of Nest*	*Fate Of Nest*
160	10	1[b]		May 20	Hatched
161				May 18-19	Hatched
163	12	1		Unknown[c]	Hatched
164	11			June 2	Depredated
164	16	4	7.6x22.9x30.5	May 27	Hatched
169	5			Apr. 29	Hatched
171	4			May 2	Hatched
172	10		3.8x25.4x25.4	May 9	Hatched
173				Apr. 28	Hatched
176	12	4	1.3x21.6x30.5	May 2	Hatched
177	13	1	5.1x26.7x27.9	Apr. 28	Hatched
178	11		7.6x31.8x33.0	May 8	Depredated
179			3.8x17.8x25.4	May 9	Depredated
502	9	1	1.3x25.4x25.4	May 17	Hatched
505	12	Unknown	0x21.6x27.9	May 6	Hatched
506	12	3	12.7x21.6x21.6	Apr. 29	Hatched
508	10		5.1x19.1x19.1	May 12	Abandoned
510	8		5.1x21.6x25.4	May 6	Depredated
714	10		5.1x27.9x30.5	May 16	Hatched
715	9	3	2.5x17.8x25.4	May 25	Hatched
716			5.1x27.9x30.5	May 12	Depredated
717			not located	Apr. 27	Unknown
718	7[d]		3.8x30.5x33.0	May 30	Hatched

[a]Number of eggs found after beginning of incubation.
[b]One poult found dead in nest after hatch.
[c]Transmitter failed before hatching; inspection of nest following calculated hatch date revealed normal hatch had occurred.
[d]Number of eggs found in nest; 2 eggs found near nest were not included.

incubation had begun. Williams et al. (1969) observed a similar small clutch and speculated that the hen was interrupted while laying and forced to complete laying in a second nest, or that some eggs may have been removed by a predator.

Nest Predation

Predators destroyed 6 of the 23 nests located. One hen abandoned her nest for unknown reasons late in the incubation period. Two other nests were abandoned, possibly as a result of predation, before exact locations were determined. None of the hens was seriously hurt during predation attempts, although I lost a considerable number of side feathers and most of her rectrices at the nest site. No renesting was observed for these hens.

Identification of initial predators was not determined. Traps concealed at 4 depredated nests, 1 abandoned nest, and 11 dummy nests of chicken eggs provided some information on predator species. A raccoon was captured at 1 nest shortly after it was depredated. Another depredated nest nearby was molested but the predator escaped. Traps at 5 of 11 dummy nests, including 1 established near the 2 depredated sites, captured raccoons. One opossum was taken at a dummy nest. Four other dummy nests were molested but the predators escaped.

We were unable to determine the reason for hen 508 abandoning her nest on the 24th day of incubation. The nest was neatly covered with a layer of feathers and it appeared that the hen had intentionally covered the eggs. No additional feathers were found near the nest to suggest a predation attempt. The hen did not return to the nest and after 4 days we removed the eggs for examination. Six contained fully developed, 25-to-26-day-old embryos, which were apparently alive at collection. A partially developed embryo was found in 1 egg.

Brood Range

Of the 15 telemetered broods tracked 10 hatched in saw palmetto dominated habitat, 2 in oak-pine forest and 2 in old field situations. The nest location of 1 instrumented brood was not known.

The 10 broods hatching in saw palmetto cover were within 365 m of lowland mixed hardwood or low lying pine areas. Two broods moved directly from their nests to low areas in pine forest habitat, where they roosted on the edge of grassy openings. The other 8 roosted their first night in saw palmetto habitat. Most of these 8 roost spots were in recently burned palmetto. Distances from nests to first-night roost sites for 7 broods ranged from 114 m to over 940 m (mean = 440 m). Three broods roosted in saw palmetto again the second night, while the 5 other broods moved into heavily forested areas and roosted in pond pine and red bay or on the edges of grassy openings in pine forest. Third night roost sites for all but 1 brood were in these low lying areas. Hen 715 and her brood continued to utilize a 5.7 ha bahia grass field surrounded by freshly burned palmetto. After 1 week the brood began using the edge and openings in a nearby lowland mixed hardwood area in addition to the field. Williams et al. (1973) found that most broods in south Florida moved directly from nesting cover through an open "grazed-glade" into cypress forest and remained there for several weeks.

Broods utilized low areas within oak-pine and pine forest types for periods ranging from 1 day to several weeks. They were particularly fond of the eges of grass ponds and openings along old ditches in the forest. Cover in these areas consisted of maiden cane and other short grasses, cinnamon fern (*Osmunda cinnamomea*), and scattered clumps of red bay. There was strong selection for areas burned the previous spring.

Most of the 10 broods moved considerable distances in a short period at some time during the first 5 days. Most notable was the 2-day-old brood of hen 177 which traveled 2.43 km. Hen 172 and her 3-day-old brood moved 1.69 km between 1155 and 1710 hours. Typical patterns of movement and range during the first 5 days after leaving nest sites in palmetto are shown in Fig. 2. Hillestad and Speake (1971) reported an average daily

movement during the summer of 0.51 km and an extreme daily movement of 1.21 km for turkey broods in Alabama. By comparison, 7 broods averaged 1.22 km during their second day (first full day of movement for most broods).

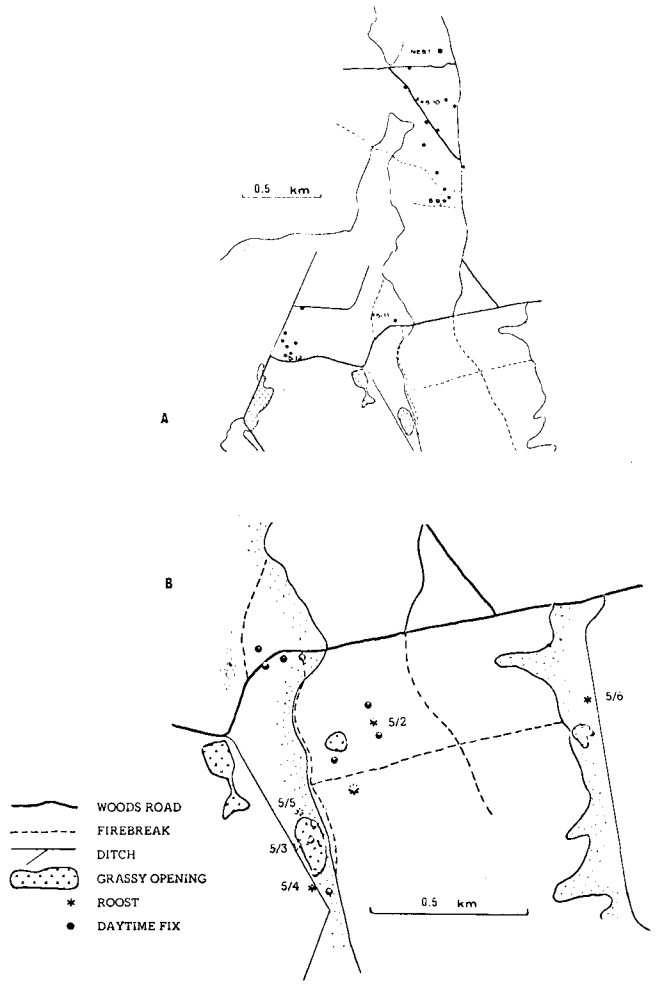

Fig. 2. Early movements and range of broods hatching in saw palmetto. A. Fixes obtained for hen 172 and brood from hatching through portions of the fifth day. B. Daytime position fixes and roost sites for hen 176 and brood from hatching through fifth night.

After remaining in heavily forested areas for varying periods of time, broods which hatched in saw palmetto habitat moved quickly (often in 1 afternoon) to a 125 ha association of old fields, bahia grass fields, grassy depressions, and regenerated pine and oak areas, near the NRB trap site. Most hens and poults were in constant association with a 42 ha old field portion of this system for several weeks. Movements were often restricted to no more than half of this field for periods of 1 week or more. Broods gradually

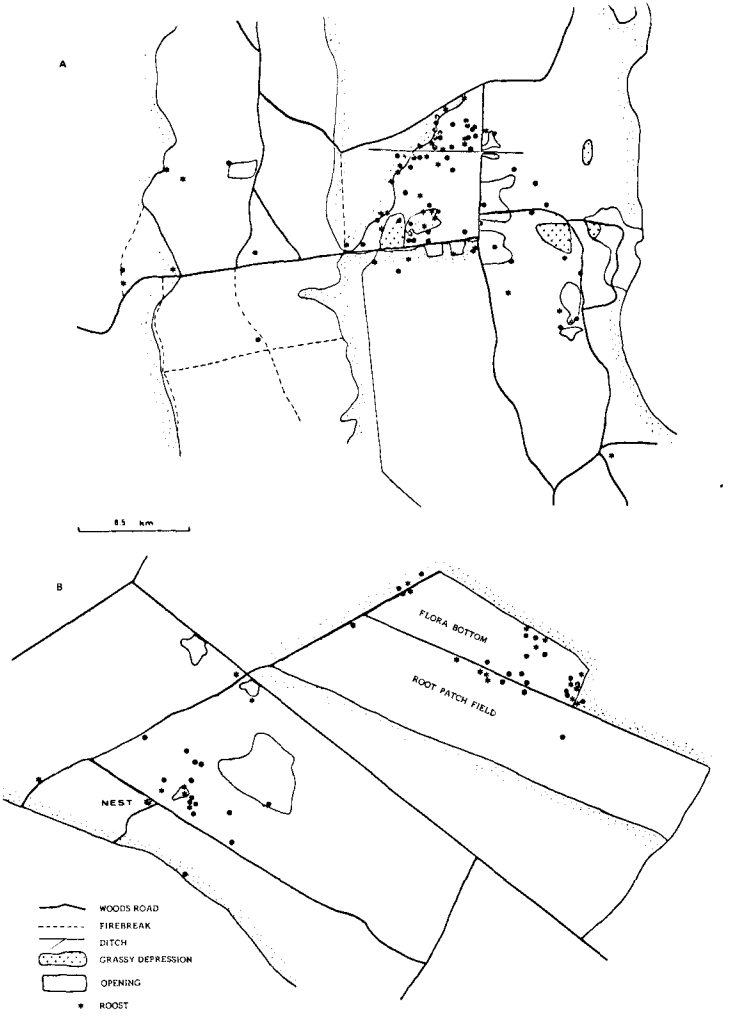

Fig. 3. A. Position fixes for hen 176 and brood from sixth day through 108th night (July 20). Hen 169 and her brood joined hen 176 and brood on June 15. Fixes made after then are for composite flock. B. Movements and range of hen 506 and poults from hatching in oak-pine forest through approximately 1 month of tracking.

extended their daily movements to other parts of the field-woods complex (Figure 3A). Hens and broods relied heavily on this area throughout the remainder of the tracking period and were observed in other locations only occasionally for short periods.

Similar movements and range were found for 2 broods that hatched in oak-pine areas on the south end of the island. Hen 506 and her poults used an area of mature oaks and pines within 500 m of the nest site for the first 6 days after hatching. Strong selection was shown for grassy openings and oak clearings. The brood then moved 0.43 km to

utilize the edges of 2 openings totaling 16 ha, created the previous year by cutting operations for beetle infestations. In 2 days the brood traveled 1.46 km to an old field system of wax myrtle and blackberry (*Rubus* sp.) thickets with scattered pines and oaks. Range during the next month totaled 34 ha associated with these fields. (Figure 3B).

Hen 714 had the smallest range of the 15 brood hens. After hatching on the edge of a small field she immediately moved with her brood to the adjoining 42 ha old field used by other broods hatched on the north end. Movements of her brood were limited to 76 ha within this old field system during 1 month of tracking.

Nesting Success and Poult Survival

Eighteen of 36 monitored hens (50%) nested successfully. The percentage of hens hatching broods varied for the 3 years. In 1975 3 of 10 monitored hens (30%) were successful. Nine of 10 hens (90%) hatched broods in 1976, while the 1977 success rate was again low with 6 of 16 radio-equipped hens (37.5%) producing broods. One hen in 1975, 1 in 1976, and 5 in 1977 nested unsuccessfully. The remaining 6 hens in 1975 and 5 hens in 1977 either did not attempt to nest or their unsuccessful nesting attempts were not detected.

Information on poult survival was obtained for 10 of the 18 broods produced. In 1975, hen 160 was observed with no poults 22 days after hatching. Hen 165 was observed with 2 poults approximately 30 days old. In 1976, hens 164 and 171 had lost their broods at 55 and 49 days, respectively. On the morning of July 21 hens 169 and 176 were observed roosting in separate trees near each other. Hen 169 had 3 112-day-old poults with her and hen 176 had 6 109-day-old poults of her original brood of 8. Early poult mortality was determined for 2 broods in 1977. Hen 715 and 718 lost their entire broods at 15 and 7 days respectively. Hen 505 had 1 surviving poult at 21 days. Five 31-day-old poults were observed on the roost with hen 506. Overall poult survival as determined from these observations was 1.7 poults per successfully nesting hen. Speake et al. (1970) estimated an average survival of 3.2 to 4.8 poults per successful hen over a 3 year period in Alabama.

The limited observations of poor brood survival along with observations of numerous other hens without broods in 1975 were reflected in a net decrease of 2 for the 1976 pre-nesting hen population (26 birds).

In 1976, 9 surviving poults (age 109-112 days) in 2 broods accounted for 31% of an original total of 29 poults hatching in 4 broods. The observed relatively high poult survival and nesting success (90%) were apparently representative of overall reproductive success of the population. Given these hatching and survival rates, a 50/50 poult sex ratio, an average 1976 brood size of 9 (Table 3), and no winter mortality, the calculated 1977 pre-nesting hen population would have been 58. Actual spring counts prior to trapping revealed 55 hens.

Observed poult survival in 1977 was considerably lower; of 25 poults hatching in 3 broods, 5 (20%) could be accounted for at 30 days. Assuming a 1977 nesting population of 48 hens (55 minus 7 birds which later died or were relocated), a nesting success rate of 37.5%, average natality of 8 poults per brood (Table 3), and 20% poult survival, the hen population the following spring should have been 62. Direct counts in the spring of 1978 revealed 62 hens.

Hatching and poult survival rates determined by radio-telemetry appeared to be accurate indicators of reproductive performance of the island turkey population. Based on these data the population experienced poult mortality approaching (and perhaps exceeding) 80% in some years. Glidden and Austin (1975) indicated that an established turkey population could be sustained with a poult mortality of 80%. The Sapelo population appears to be sustaining itself within the confines of the island habitat. However, in view of fluctuating recruitment rates, overall low productivity, and a small total population, caution should be exercised in future relocation activities.

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