

Mortality and Reproduction of Stocked Eastern Turkeys in East Texas

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Abstract: Mortality and reproduction of 65 stocked eastern turkeys (*Meleagris gallopavo silvestris*) were studied using radio telemetry on 2 different areas in east Texas from February 1979 through July 1981. The known survival rate was 62% after 1 year and 48% at the end of the study period. The known mortality rate was 11% after 1 year and 21% at the end of the study period. Predation on hens during the nesting and early brood-rearing season was the greatest loss of adult turkeys. A high rate of nesting and renesting indicated a high reproductive potential for these turkey populations. Average poult loss for 3 reproductive seasons was >67% and nearly all losses were recorded within 14 days after hatching. Low poult survival was considered the greatest limiting factor on the turkey populations.

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Turkey restoration in east Texas began in 1924 (Newman 1945). In 1942, the native population of eastern turkeys in east Texas was probably <100. The recent success Texas has had in obtaining wild-trapped eastern turkeys from other states has accelerated the restoration program in east Texas. Past research has indicated that the mortality rate for turkeys may prevent the expansion of some populations (Williams et al. 1968, Speake et al. 1969). Other research has shown turkeys to have a high reproductive potential (Glidden and Austin 1975, Williams et al. 1976, Everett et al. 1980). However, most of the previous research has been conducted with established, resident turkey populations. Prior to this study, data were not available on the mortality rate and reproduc-

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tion of newly established eastern turkeys in east Texas. Data presented here are adult turkey mortality, reproduction, and poult survival for February 1979 to August 1981.

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Methods

Study Areas

The 2 study areas (125 km apart) were located in the East Texas Timber Land Resource Area, which encompasses approximately 6.4 million ha in the Southern Coastal Plain (Godfrey et al. 1973). Perennial streams provided water throughout the year on the areas. The major land use on both areas was timber production. Both areas were closed to general public access.

The Beef Creek study area was located in Jasper County, approximately 3 km north of Jasper. The major landowner was Temple-Eastex, Inc. The area was composed of approximately 11,000 ha and included pine plantations 1–10 years old (15%), pine poletimber and sawtimber (70%), bottomland hardwood and pine-hardwood (14%), and openings (1%). Topography of the area was gently rolling to hilly.

The Brushy Creek study area was located in Polk and Trinity counties, 5 km south of Groveton. Most of the research was conducted on the 10,000-ha Brushy Creek Wildlife Management and Research Area, owned by St. Regis Paper Co. About 16% of the management area was pine plantations 1–10 years old; 5% was openings, 5% was pine-hardwood, and 74% was pine stands. Topography of the area was gently rolling.

Procedures

Forty eastern turkeys were released on Brushy Creek and Beef Creek (8 gobblers and 12 hens on each area) in February and early March 1979. Twelve additional hens were released on Brushy Creek and 13 hens were released on Beef Creek in February 1980. Radio telemetry was used to monitor the turkeys as they adjusted to the new habitat. Sixty live-trapped turkeys were provided by the Louisiana Wildlife and Fisheries Commission, and 7 turkeys were provided by the Mississippi Department of Conservation. Two of the hens died

prior to release due to trapping injuries and were not included in the total number released. The turkeys released in 1979 were monitored between 9 February 1979 and 7 August 1981, a period of 30 months. The turkeys released in 1980 were monitored for a period of 17 months.

Turkeys were released near the center of each study area. Prior to release, all turkeys were individually marked with patagial tags (Knowlton et al. 1964) and fitted with 90-g solar powered transmitters (150–152 MHz) (Williams et al. 1968).

Triangulation (Cochran and Lord 1963), using a medium-gain Yagi antenna mounted through the roof of a truck, was used to obtain the majority of locations (fixes). The peak signal and a hand-held compass were used to determine the direction of the transmitter. A fixed-wing aircraft was used to locate far-ranging turkeys or those in which radio contact from the ground had been lost.

Each transmitter was equipped with a mercury tip-switch that increased the pulse frequency when the turkey was standing. A slight shift in position caused the pulse frequency to change. Movement by a turkey was indicated by a variable pulse rate. Continuous incubation behavior was indicated by a slow steady pulse rate.

Except for nesting hens, adult turkey mortality was investigated as soon as possible after transmitter signals indicated no movement by the turkey. Predation was indicated by feather and carcass remains; however, predators were not identified. Turkeys were recorded as alive when radio signals indicated movement by the turkey or when observed and positively identified by the color code on the patagial tags. Unknown fate of a turkey was recorded after failure to locate the transmitter from the ground or aircraft, location of the transmitter with no sign of predation observed in the area, or no subsequent sighting of the turkey.

Fixes were collected at random intervals, primarily during daytime. In the spring and summer months, at least 3 fixes per week were collected for each hen to determine the date of nest initiation. Day and night tracking, along with pulse frequency, was used to determine the initiation of continuous incubation behavior. When morning and afternoon fixes for a hen had the same bearings and the hen was believed nesting, then a fix was obtained after sunset to determine if the hen had moved from the nest. The first night a hen was observed roosting on the nest was recorded as the beginning of continuous incubation behavior.

Clutch size after hatching was determined in the first and second reproductive seasons for hens released in 1980 and the second and third reproductive seasons for hens released in 1979. After about 12 days of continuous incubation, each nest was located with 3 or more bearings taken about 20 m from the nest. A hand-held antenna was used to approach each nesting hen and signal intensity was used to remain a sufficient distance away from the nest to prevent disturbing the hen. Each bearing around the nest was flagged and re-

corded to aid in locating the nest. Nesting hens were located daily to monitor nesting activity. After hatching or destruction of the nest, the nest was inspected and the number of eggs counted.

Newly hatched broods were monitored throughout the first day. Broods were located each day for most of the remainder of the brood period. An attempt was made to observe the broods each week to determine poult survival. Poult survival was based on clutch size observed after hatching. Poult counts in August were used as an estimate of poult survival and reproduction for the year.

Results

Known Survival Rate

Survival of turkeys was based on 14 gobblers and 24 hens released in 1979 and 25 hens released in 1980 (Table 1). One year after release, at least 39 turkeys (62%) were known to be alive, and the fate of 17 turkeys was unknown because of loss of radio contact. In August 1981, at least 30 turkeys (48%) were known to be alive, and the fate of 20 turkeys was unknown.

The known survival rate for gobblers was 71% after 1 year (Table 2). Two gobblers died within 5 days after release due to trapping injuries and were not included in the calculations. The known survival rate was 64% after 2 years and 50% at the end of 2.5 years. The known survival rate for hens released in 1979 was 58% after 1 year. One hen died prior to release due to trapping injuries and was not included in the calculations. The known survival rate was 54% after 2 years and 46% at the end of 2.5 years. The known survival rate for hens released in 1980 was 60% after 1 year. One hen died prior to release due to trapping injuries and was not included in the calculations. The known survival rate at the end of 17 months was 48%.

Table 1. Mortality and survival for 63 eastern turkeys stocked in 1979 and 1980 on Beef Creek and Brushy Creek study areas, February 1979–August 1981.^a

| Months after release | 1979 release | | | | | | 1980 release | | |
|----------------------------|----------------|---|---|------|---|---|--------------|---|---|
| | Gobblers | | | Hens | | | Hens | | |
| | A ^b | D | U | A | D | U | A | D | U |
| 0 | 14 | | | 24 | | | 25 | | |
| 6 | 11 | 1 | 2 | 16 | 1 | 7 | 17 | 2 | 6 |
| 12 | 10 | 2 | 2 | 14 | 1 | 9 | 15 | 4 | 6 |
| 18 | 9 | 2 | 3 | 14 | 1 | 9 | 12 | 6 | 7 |
| 24 | 9 | 2 | 3 | 13 | 2 | 9 | | | |
| 30 | 7 | 3 | 4 | 11 | 4 | 9 | | | |

^a In addition, 2 gobblers and 2 hens died shortly after release due to trapping injuries.

^b A = alive, D = dead, U = unknown fate.

Table 2. Cumulative survival table based on Table 1 for 63 eastern turkeys stocked in 1979 and 1980 on Beef Creek and Brushy Creek study areas, February 1979–August 1981.

| Months after release | 1979 release | | | | 1980 release | |
|----------------------|---------------|----------------|---------------|----------------|---------------|----------------|
| | Gobblers | | Hens | | Hens | |
| | Survival rate | Mortality rate | Survival rate | Mortality rate | Survival rate | Mortality rate |
| 0–6 | 0.79 | 0.07 | 0.67 | 0.04 | 0.68 | 0.08 |
| 6–12 | 0.71 | 0.14 | 0.58 | 0.04 | 0.60 | 0.16 |
| 12–18 | 0.64 | 0.14 | 0.58 | 0.04 | 0.48 | 0.24 |
| 18–24 | 0.64 | 0.14 | 0.54 | 0.08 | | |
| 24–30 | 0.50 | 0.21 | 0.46 | 0.17 | | |

Known Mortality Rate

At least 7 turkeys (11%) were known to be dead 1 year after release (Table 1). After 30 months for turkeys released in 1979 and 17 months for turkeys released in 1980, 13 (21%) were known dead due to predation and poaching. No known mortality was associated with attachment of the transmitters to the turkeys.

The known mortality rate for gobblers increased from 7% after 6 months to 21% after 30 months (Table 2). The known mortality rate for hens released in 1979 increased from 4% after 6 months to 17% after 30 months. One hen died as a result of being illegally shot. Unknown predator(s) killed 1 hen in October, 1 hen during continuous incubation behavior, and 1 hen 5 days after hatching poults. The known mortality rate associated with nesting and brood rearing was 8%. The known mortality rate for hens released in 1980 increased from 8% after 6 months to 24% after 17 months. Unknown predator(s) killed 1 hen in September, 1 hen in January, 3 hens during continuous incubation behavior, and 1 hen within 5 days after hatching poults. The known mortality rate associated with nesting and brood rearing was 16%.

Nesting

In the first nesting seasons after release, the minimum number of days after release before continuous incubation behavior was 53 and averaged 66 days. The beginning date for continuous incubation ranged from 1 April to 11 June. The peak period for beginning date of continuous incubation behavior throughout the study period was between 15 April and 1 May.

Nesting rate and success were determined for the first (28 hens), second (25 hens), and third (11 hens) reproductive seasons after release (Table 3). The nesting rate was highest in the second reproductive season. Nearly all of the hens that nested exhibited continuous incubation behavior, except in the third reproductive season. About half of the hens that incubated were suc-

Table 3. Nesting rate and success for turkey hens stocked in 1979 and 1980 on Beef Creek and Brushy Creek study areas for the 1979–81 reproductive seasons.

| Parameter | Reproductive season after release | | | | | |
|---------------------------------|-----------------------------------|----|-----|-----|-----|-----|
| | 1st | | 2nd | | 3rd | |
| | N | % | N | % | N | % |
| Monitored | 28 | | 25 | | 11 | |
| 1st nests | | | | | | |
| Nested | 22 | 79 | 24 | 96 | 10 | 91 |
| Incubated | 21 | 95 | 22 | 92 | 5 | 50 |
| Successful | 10 | 48 | 11 | 50 | 4 | 80 |
| Hen with poults ^a | 4 | 40 | 9 | 82 | 1 | 25 |
| Renests | | | | | | |
| Nested | 0 | | 3 | 23 | 6 | 100 |
| Incubated | | | 3 | 100 | 6 | 100 |
| Successful | | | 1 | 33 | 3 | 50 |
| Hen with poults | | | 0 | 0 | 1 | 33 |

^a Based on brood counts in August.

cessful in hatching poults. Predation or other reasons for failure to hatch poults after incubation had begun was not determined for most of the nests. Five nests were believed destroyed by snakes because nest material was undisturbed and no sign of egg remains was present at the nest site. Extensive flooding due to rainfall prior to and during the incubation period was considered the predisposing cause for nest failures in the third reproductive season. The percentage of hens with poults was highest in the second reproductive season.

No renesting attempts were recorded in the first reproductive season (Table 3). Nine hens renested in the second and third reproductive seasons. All of the hens that renested exhibited continuous incubation behavior. One renesting hen was successful in hatching poults in the second reproductive season. Three of the 5 eggs in the clutch were only partially developed after 27 days of incubation. In the third reproductive season, 1 hen renested twice but was killed on the nest by an unknown predator(s). One hen abandoned her nest due to illegal deer hunting using dogs and 1 hen was killed by an unknown predator(s) within 5 days after hatching poults. One hen had 1 poult in August from renest attempts.

Initial nest attempts for the 3 reproductive seasons yielded an average nesting rate of 88%. Incubation rate averaged 86% and nest success averaged 52% for the 3 reproductive seasons. Fifty-six percent of the hens successful in first nest attempts raised poults to August. The renesting rate for the second and third reproductive seasons averaged 47%.

Table 4. Poultry survival for turkey hens stocked in 1979 and 1980 on Beef Creek and Brushy Creek study areas for the 1980–81 reproductive seasons.

| Age of poults when counted ^a | Reproductive season after release | | | | | | | | |
|---|-----------------------------------|----|------|-----------------|----|------|-----|----|------|
| | 1st | | | 2nd | | | 3rd | | |
| | NP ^b | NB | NP/B | NP | NB | NP/B | NP | NB | NP/B |
| 1st nests | | | | | | | | | |
| Hatching | 26 | 4 | 6 | 65 ^c | 10 | 6 | 29 | 4 | 7 |
| 1–14 days | 3 | 2 | 2 | 42 | 9 | 5 | 8 | 2 | 4 |
| % loss | 88 | | | 35 | | | 72 | | |
| 15–30 days | 3 | 2 | 2 | 42 | 9 | 5 | 8 | 2 | 4 |
| % loss | 0 | | | 0 | | | 0 | | |
| >30 days | 3 | 2 | 2 | 36 | 9 | 4 | 1 | 1 | 1 |
| % loss | 0 | | | 14 | | | 88 | | |
| Total % loss | 88 | | | 45 | | | 96 | | |
| Renests | | | | | | | | | |
| Hatching | 0 | | | 2 | 1 | 2 | 16 | 3 | 5 |
| 1–14 days | | | | 0 | | | 1 | 1 | 1 |
| % loss | | | | 100 | | | 94 | | |
| 15–30 days ^d | | | | | | | 1 | 1 | 1 |
| % loss | | | | | | | 0 | | |
| Total % loss | | | | | | | 94 | | |

^a The category >30 days represents the count in August.

^b P = poults, B = broods.

^c Minimum number of poults at hatching and minimum poult loss because 5 nests were not located after hatching.

^d The brood was monitored through poult age 22 days at the end of the study period.

Poult Survival

Poult survival and reproductive success were greatest in the second reproductive seasons (Table 4). The majority of poult losses occurred between 1 to 14 days after hatching. Poult losses after 14 days old were attributed to poaching and represented 14% in the second reproductive season (poults 50 days old) and 88% in the third reproductive season (poults 64 days old). Poult survival between broods was highly variable. Two hens hatched a total of 13 eggs in the second reproductive season and raised all 13 poults to August. Average reproductive success from initial nest attempts ranged from 1 poult per brood in the third reproductive season to 4 poults per brood in the second reproductive season. Three entire broods were lost to unknown predators. Poult survival and reproductive success from renests were low. Only one poult was produced from reneest attempts.

Discussion

Adult turkey mortality in this study ($\leq 38\%$) was lower than the annual mortality rate of 50% which was considered normal for adult turkeys (Mosby 1967). Mortality factors included capture injuries, predation, and poaching. Most of the mortality occurred within 1 year after release. Speake et al. (1969)

reported a low loss (9%) during the first year after release for turkeys stocked in Alabama. Predation on hens during the nesting and early brood-rearing season was the greatest loss of adult turkeys. Everett et al. (1980) reported a 19% loss of hens from April to June.

A high propensity for nesting and renesting was observed on the study areas and indicated a high reproductive potential for these turkey populations. Nearly all of the nest predation occurred after continuous incubation had begun. Williams et al. (1980) concluded that because of the high reproductive potential of turkeys, nesting losses are not severely limiting to populations. Nesting success observed in this study was comparable to success reported by Everett et al. (1980) for resident turkeys in Alabama.

Reproductive success was greater for hens during the second than the first reproductive season after release. The trend of increased reproductive success was similar for hens that were released in 1979 and 1980. Hens generally began incubation within 2 months after release, which included extended movements to explore and adjust to the new habitat. Hopkins et al. (1982) reported that turkeys made extended movements from release site until 7 to 8 months after release. These extended movements possibly contributed to the majority of the poult losses occurring within 2 weeks after hatching. Although no re-nesting attempts were recorded in the first reproductive season, 47% re-nesting for the second and third reproductive seasons was greater than the rate reported by Everett et al. (1980). However, re-nesting contributed very little toward increasing the populations.

There was much variation in poult survival for individual broods. The data support other research (Everett et al. 1980, Glidden and Austin 1975) in that most of the poult mortality occurred within 2 weeks after hatching. Loss of poults after 2 weeks old was attributed to poaching. Fleming and Speake (1976) reported that illegal kill of large poults was a major factor in loss of turkeys in central Alabama.

Adult turkey losses to predation were low compared to poult mortality. Low poult survival was considered the greatest limiting factor on the turkey populations. Management should be directed towards increasing poult survival to accelerate the increase of newly established turkey populations. Stocking during fall or early winter rather than in late winter or early spring may be 1 means to increase poult survival. Turkeys would be better adjusted to their new habitat which may result in a higher reproductive success in the first year.

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