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REPRODUCTIVE PERFORMANCE OF RIO GRANDE WILD TURKEYS[1]

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Abstract. Frequency, magnitude, and timing of reproduction in Rio Grande Wild Turkey (*Meleagris gallopavo intermedia*) hens were studied in northeastern Colorado in 1986 and 1987. All adults (n = 12) and 95% (n = 20) of yearlings were known to attempt nesting. Adults initiated first nest attempts earlier than yearlings in 1987 but not 1986. Adults and yearlings did not differ in clutch size or nesting success. There was an inverse relationship between clutch size and initiation date of first nests by adults. Clutch and egg size, however, were not related. Among yearlings, body mass at capture in February was positively correlated with subsequent nest-initiation date. Environmental and social stimuli, but not winter severity, are hypothesized proximate conditions regulating reproduction in this Wild Turkey population.

Key words: Clutch; Colorado; Meleagris gallopavo intermedia; *nest initiation; reproduction; Wild Turkey.*

INTRODUCTION

The Rio Grande Wild Turkey (*Meleagris gallopavo intermedia*) is endemic to northern Mexico, Texas, Oklahoma, and southern Kansas (Aldrich 1967). Transplanting programs have extended the range of this subspecies from California (Graves 1975) to North Dakota (Aldrich 1967). Although several studies of Rio Grande Wild Turkeys have been reported from Texas (e.g., Watts 1968, Beasom and Pattee 1980, Ransom et al. 1987), little is known about the reproductive ecology of newly established populations in other habitats. Information on reproductive performance of this subspecies is necessary to understand its population dynamics.

Beasom and Pattee (1980), working in southern Texas, reported productivity of Wild Turkeys was correlated with amount of previous fall and current spring rainfall. Greater soil moisture resulting in more vigorous plant growth of higher nutritional value was the hypothesized mechanism affecting reproduction. On the Welder Wildlife Refuge in southern Texas, Ransom et al. (1987) postulated that predation, primarily of nests, was the major limiting factor for Rio Grande Wild Turkeys. In more northerly habitats, winter severity has been suggested as a major factor limiting Eastern Wild Turkey populations (*M. g. sylvestris*) (Porter et al. 1983, Gray and Prince 1988).

We studied the reproductive performance of an introduced population of Rio Grande Wild Turkeys in riparian habitats in northeastern Colorado in 1986-1987. Nesting rates, hen success, and temporal patterns in nest initiation were investigated to better understand the population dynamics of Rio Grande Wild Turkeys in a non-native, more northerly habitat.

STUDY AREA

The study was conducted along the South Platte River in Logan, Morgan, and Washington counties in northeastern Colorado. Elevation varied from 1,130 to 1,322 m in a gradual east-west gradient. Annual precipitation averaged 36 cm; mean January and July temperatures were −4.5 and 23.5°C, respectively (National Oceanic and Atmospheric Administration 1986). The river-bottom community extended to 1.0 km in width and was dominated by an open-canopied plains cottonwood (*Populus sargentii*) forest. Discrete

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clumps of woody shrubs, primarily western snowberry (*Symphoricarpos occidentalis*), occurred in an understory dominated by cheatgrass brome (*Bromus tectorum*), prairie cordgrass (*Spartina pectinata*), inland saltgrass (*Distichlis stricta*), and a variety of forbs (plant names follow Scott and Wasser [1980]). Lindauer (1983) provided a complete vegetative description of this particular community.

Private lands adjacent to the riverbottom were primarily used for production of alfalfa, corn, wheat, and other small grains and row crops. Cattle were grazed at varying intensities both in and adjacent to the riverbottom. The Colorado Division of Wildlife owned approximately one-third of the riverbottom in the study area. These lands were not grazed and were used for both consumptive and nonconsumptive recreation.

Sixty Rio Grande Wild Turkeys from Kansas and Texas were introduced to the study area during 1980–1983. No Wild Turkeys had previously existed in northeastern Colorado.

METHODS

Turkeys were trapped in February 1986 and 1987 with drop nets and Clover traps. Captured birds were classified to age and sex, weighed, measured for carpal and primary feather lengths, and fitted with aluminum leg bands. Turkeys were classified as yearlings (<1 year of age) or adults (>1 year of age) based on characteristics of primary IX and X (Petrides 1942). Females were fitted with transmitters mounted on ponchos (Amstrup 1980) or attached to the central pair of rectrices (Bray and Corner 1972). Poncho and tail clip transmitters weighed 29–32 g and 26–29 g, respectively, and had expected battery lives of 6 months.

Turkeys were relocated at least once every 4 days prior to winter flock breakup and dispersal. Once dispersal ceased and individual hens localized, they were relocated every 1–2 days to ascertain nest initiation. Birds were approached to within 25 m and the location flagged so that nests could be found after hatching, depredation, or abandonment. Dispersal distance was measured from the approximate center of the flock winter range to a nest site. Distances were measured parallel to the river because no turkeys were observed >0.5 km from the riparian area along the river. Differences between ages and years were tested with Mann-Whitney tests.

Clutch size and number of hatched eggs were determined from eggshell characteristics. When eggshells were sufficiently intact, widths were measured with calipers. Clutch and egg-size comparisons used data from successful first nest attempts and unsuccessful first nest attempts where clutches were observed prior to nest destruction. Differences in clutch size, numbers of eggs hatched, and egg width between age classes were tested using analysis of variance (ANOVA) with age, year, and age-year interactions specified as main effects. Egg widths within a clutch were averaged and the mean value entered into the ANOVA. Nest-initiation date as a predictor of clutch size and egg width was examined with linear regression. Hen success was defined as hatching ≥ 1 egg during all nest attempts. Differences in hen success between years and age classes were tested with *G*-tests. Abandonment caused by observer disturbance and females not attempting to nest were not included in hen success analyses.

Nest-initiation dates were estimated by counting eggshells and assuming one egg laid/day and a 28-day incubation period (Bailey and Rinnell 1967). Initiation dates for unsuccessful nests were estimated by calculating the egg-laying period from the first date of suspected incubation ascertained from activity data. Differences between age classes in nest-initiation dates and nest fates were tested with median tests. The power of nest-initiation date as a predictor of hen age and nest fate was examined with logistic regression analysis. The relationship between winter body mass and subsequent date of first nest initiation was analyzed using linear regression. The Statistical Analysis System was used for all analyses (SAS Institute 1987).

RESULTS

Five adult and eight yearling females, and six adult and 12 yearling females were radiomarked, respectively, in 1986 and 1987. In 1987 a nest of an unmarked adult was found and the data included in all but the dispersal analyses (age ascertained from egg dimensions). Dispersal distances did not differ between years and the data were pooled. Dispersal began in mid-March with peak movements occurring from the third week in March through the first week in April. Yearlings dispersed farther ($n = 18$, $\bar{x} = 35.5$ km, SE $= 4.1$ km, $U = 2.61$, $P = 0.009$) from winter flocks to nest sites than adults ($n = 11$, $\bar{x} = 14.3$ km, SE $= 4.9$ km). Three yearling hens dispersed

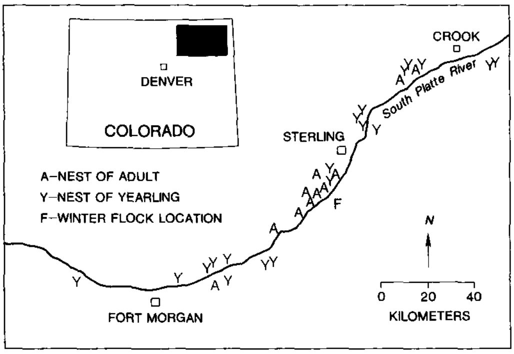

FIGURE 1. Winter flock location and nest locations of Wild Turkeys in northeastern Colorado, 1986–1987. Shaded portion of state map represents study area.

>60 km. Within age classes, dispersal was not uniform across the study area (Fig. 1).

All 12 adult and 19 of 20 yearling females were known to attempt nesting. Adults and yearlings did not differ in date of first nest initiation in 1986, but adults initiated nests earlier than yearlings in 1987 (Table 1). Nest-initiation date was not a significant predictor of hen age ($P = 0.163$). Most nests (67%) were initiated between mid-April and mid-May (Fig. 2).

Fifty-eight percent of nesting hens successfully hatched eggs. Fifteen of 36 nests were destroyed by predators, mostly raccoons (*Procyon lotor*) and striped skunks (*Mephitis mephitis*), and three were abandoned, two of which may have been observer-induced. Five hens were attacked while on nests with one known mortality, probably by a coyote (*Canis latrans*). Three yearlings were known to renest and one adult renested twice. Hen success was not dependent on age ($G = 2.38$, $P = 0.123$) for years combined. In 1987, six of seven adults hatched eggs compared to only five of 12 yearlings, but statistical comparison was hampered by small sample size. Initiation dates of successful first nest attempts (median = 21 April) tended to be earlier than unsuccessful first attempts (median = 5 May) ($P = 0.073$). Date of nest initiation was a marginally significant predictor of nest fate ($P = 0.077$). The first nest initiated had a 74 ± 13% (SE) probability for success whereas the probability for success for the last nest was only 6 ± 9%.

Clutch size of adults was not dependent on nest-initiation date when all 11 data points were examined ($r^2 = 0.265$, $P = 0.101$). The two latest nesting adults initiated nests >1 month after the next latest adult. The localized behavior of these

TABLE 1. Initiation dates of first nest attempts by Wild Turkeys in northeastern Colorado, 1986–1987.

Year / Age	Median	Range	P[a]
1986			
Adult	27 April	11 April–6 June	0.575
Yearling	24 April	17 April–14 May	
1987			
Adult	16 April	10 April–12 June	0.032
Yearling	6 May	27 April–2 July	

[a] Median test for age differences.

two hens indicated they may have initiated earlier nests that we did not find. With these two outliers excluded, nest-initiation date was a significant predictor of both clutch size ($r^2 = 0.723$, $P = 0.004$) (Fig. 3) and number of eggs hatched ($r^2 = 0.763$, $P = 0.010$). Exclusion of these two outliers did not alter relationships among age, nest fate, and nest-initiation date. Adult clutch sizes ($n = 11$, $\bar{x} = 11.3$, SE = 0.68) were not significantly larger than yearling clutch sizes ($n = 10$, $\bar{x} = 10.0$, SE = 0.82, $P = 0.233$). Numbers of hatched eggs also did not differ between age classes (adults, $n = 8$, $\bar{x} = 10.0$, SE = 1.0; yearlings, $n = 7$, $\bar{x} = 8.6$, SE = 0.57, $P = 0.255$). Eggs of adults were wider ($n = 12$, $\bar{x} = 47.97$ mm, SE = 0.51, $P = 0.022$) than eggs of yearlings ($n = 20$, $\bar{x} = 46.54$ mm, SE = 0.31), but there was no relationship between egg width and initiation date or clutch size ($r^2 < 0.1$, $P > 0.10$). Year and age-year interactions were not significant in any ANOVA ($P > 0.10$). Poncho-marked birds were not different from tail-clip marked birds in date of first nest initiation, clutch size, number of eggs hatched, nor nest success ($P > 0.25$ for all tests).

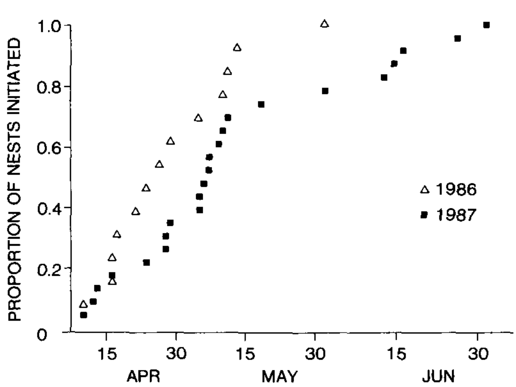

FIGURE 2. Cumulative nest initiation for Wild Turkeys in northeastern Colorado, 1986–1987.

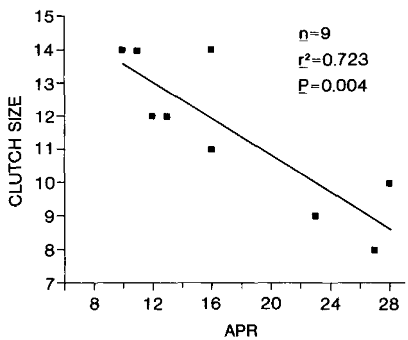

FIGURE 3. First nest initiation date as a predictor of clutch size for adult Wild Turkeys in northeastern Colorado, 1986–1987.

Body mass of hens captured in February was a significant predictor of subsequent first nest-initiation date for yearlings but not adults. Lighter weight yearlings nested earlier than heavier yearlings (n = 19, r^2 = 0.226, P = 0.024). Omission of the two latest nesting yearlings appeared justified as these hens did not nest until late June when the effects of winter body condition on nest-initiation date were probably inconsequential. Winter body mass accounted for 41% of the variance in nest-initiation date for the truncated data set (P = 0.006) (Fig. 4). When this data set was examined by years, the relationship was evident in 1986 (n = 7, r^2 = 0.525, P = 0.065) but not in 1987 (n = 10, r^2 = 0.041, P = 0.573). Mean mass of each age and sex class was lower in 1986 than 1987, although this difference was significant only for adults (P = 0.056) (Table 2). Most statistical tests had low power due to small sample sizes. Thus, small, but real, differences between groups may have gone undetected.

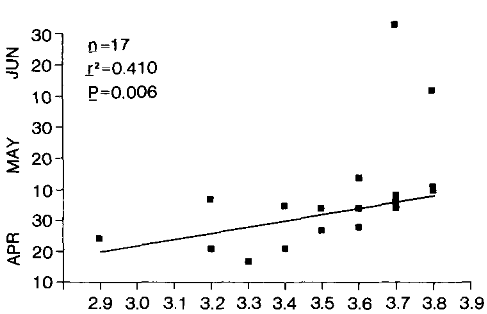

FIGURE 4. Winter body mass as a predictor of nest-initiation date for yearling Wild Turkeys in northeastern Colorado, 1986–1987.

TABLE 2. Body mass (kg) of female Wild Turkeys captured in February 1986–1987 in northeastern Colorado.

				Interyear difference	
Age	n	$\bar{x}$	SE	(%)[a]	P[b]
Adults					
1986	5	3.96	0.11	4.4	0.358
1987	6	4.13	0.14		
Yearlings					
1986	11	3.42	0.07	5.1	0.056
1987	17	3.59	0.05		

[a] [(1987 mean mass/1986 mean mass) − 1)] × 100.
[b] t-test for differences in body masses between years within age classes.

DISCUSSION

Population dynamics in many birds are affected by differences in reproductive performance between age classes. Compared to yearlings, adult females generally nest more frequently, earlier (Hannon et al. 1982) and with greater success, lay larger clutches (Wallestad and Pyrah 1974, Giesen et al. 1980), and lay bigger eggs that produce young with higher survivorship (Ankney 1980). In Wild Turkeys, these reproductive parameters are poorly understood.

Adult clutch sizes have been reported to be larger (Porter 1978), smaller (Glidden and Austin 1975, Reagan and Morgan 1980), and not different from yearling clutch sizes (Vangilder et al. 1987). Nest success was greater for adults than yearlings in some studies (Vangilder et al. 1987, Vander Haegen et al. 1988) but not in others (Porter 1978, Everett et al. 1980). The high rate of yearling breeding in this study (95%) is consistent with that reported by some investigators (Glidden and Austin 1975, 100%; Porter 1978, 88%; Everett et al. 1980, 85%; Vander Haegen et al. 1988, 81%), but in contrast to others (Reagan and Morgan 1980, 31%; Lutz and Crawford 1987, 31%; Wertz and Flake 1988, 0%). In Blue Grouse (*Dendragapus obscurus*), nonbreeding among yearlings has been attributed to interfemale aggression in high density populations (Zwickel 1980, Hannon et al. 1982). The interaction between population densities and reproductive performance, particularly the frequency of nonbreeding by yearlings, merits further investigation.

Delayed yearling breeding (within seasons) has not previously been addressed in the Wild Turkey literature, although it has been observed in several grouse species (e.g., Sage Grouse [*Cen-*

trocercus urophasianus], Petersen 1980; Blue Grouse, Zwickel 1977, Hannon et al. 1982). The long dispersal distances by yearlings observed in this study are consistent with the interfemale aggression hypothesis of delayed yearling breeding suggested by Hannon et al. (1982) for Blue Grouse, but data on social behavior are lacking. Also, whether these spring movements constitute dispersal vs. migration is not clear.

Most temperate bird species are seasonally constrained to nesting when food is most abundant; specifically, the female must have enough body reserves and/or food available to endure the energetic drain of egg laying and incubation (Perrins 1970). In Missouri, nest-initiation dates of Eastern Wild Turkeys were correlated with spring temperatures over a 4-year period (Vangilder et al. 1987). In both years of our study, spring temperatures were similar and vegetative growth began in early to mid-April, corresponding closely to the first observed nest attempts. Onset of Wild Turkey nesting is likely proximately controlled by spring vegetative growth or a correlate of this parameter, such as temperature.

Winter conditions may affect timing of breeding (Murphy 1986) as well as overwinter survival (Haramis et al. 1986) in birds that rely on endogenous reserves. Although it is not clear to what extent Wild Turkeys use endogenous reserves, one expects an inverse relationship between body condition (roughly indexed by body mass) and both survival and subsequent nest-initiation date (Hannon et al. 1988). Porter et al. (1983) found that Wild Turkey hens in Minnesota that weighed <4.3 kg were less likely to survive and less likely to breed than heavier hens. In our study, the low observed mortality (no birds died between 1 week after capture and early May in either year) and early nest initiation by lightweight hens suggests that winter conditions do not impact survival and timing of breeding in this population.

Lower egg production, hen success, and chick survival may proximally constrain late breeding within seasons. In this study, adults laid fewer eggs and experienced marginally higher rates of nest predation as the season progressed. Toft et al. (1984) suggested that ducks optimally apportion their reserves into either many small eggs or few large eggs, depending upon current probabilities of nest and duckling survivorship. They argued that decreasing survival of young in late season selectively favored large eggs that produced young of high survivorship. This inverse relationship between clutch and egg size, and the assumed optimal allocation of a limited energy supply, has been questioned by Rohwer (1988). He found little correlation between these two parameters for most waterfowl species examined. In this Wild Turkey population, the lack of a relationship between clutch and egg size suggests that egg production may not be limited by energetic constraints.

Further, breeding early (Vangilder et al. 1987, Hannon et al. 1988) or laying fewer eggs in later nests would increase the time available to renest. Maximizing the opportunity to renest may be important to these Wild Turkeys as 42% of all nests initiated were depredated. All four hens that were known to renest were eventually successful.

Although population density and nest predation have been separately suggested as affecting yearling breeding and clutch and egg size and timing of breeding, interaction between these two parameters is probable. We suggest that variation in frequency of yearling breeding may impact Wild Turkey population dynamics as much as nest depredation. Further studies of reproductive performance in Wild Turkeys should address these parameters simultaneously.

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