Survival and Recovery Rates of Male Wild Turkeys on Private Lands in North-central Louisiana

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Abstract: Harvest is an important mortality factor for male eastern wild turkeys (*Meleagris gallopavo silvestris*). To effectively manage harvest and ensure quality hunting it is necessary to understand the relationship between annual survival and factors such as hunter access, season length, and bag limits. We banded 261 male wild turkeys from 2002–2009 and estimated survival and recovery parameters based on band recoveries from 2002–2012 on private lands in the pine-dominated landscape of north-central Louisiana. Hunting season length was 23 days from 2002–2006 and 30 days from 2007–2012 with a 2-bird limit in all years of study. We found that survival and recovery rates varied by age class. Adult and juvenile annual survival was 0.30 (SE = 0.04) and 0.51 (SE = 0.10), whereas recovery rates were 0.28 (SE = 0.04) and 0.07 (SE = 0.02), respectively. Direct recovery rates of adults increased when season length increased to 30 days from an annual mean of 20% to 44.5%. Recovery rates were considerably lower than published estimates for public land in southeast Louisiana, suggesting that restricted hunter access on private land may lead to reduced hunting pressure and harvest. Despite low recovery rates and restricted access of hunters on private lands, survival estimates were similar to public lands in Louisiana under similar season length and bag limits. Conversely, survival rates in our study were considerably lower than a parcel of public land in south-central Louisiana with a 9 day season and limited hunter access. We offer that the minimal harvest of juveniles on our study areas likely resulted from private land hunters selectively choosing to avoid harvest of juveniles, potentially serving to maintain quality hunting as a large portion of the juvenile cohort each year was recruited into the adult population. Given that recovery rates increased when the season was lengthened, we suggest that modifying season length is a viable option for managers to control harvest mortality of male wild turkeys.

Key words: harvest, Louisiana, *Meleagris gallopavo silvestris*, survival, wild turkey

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Eastern wild turkeys (*Meleagris gallopavo silvestris*) are an important North American game species. Despite trends indicating that overall numbers of sport hunters are declining, the number of turkey hunters and turkey harvest rates has continued to rise or remain stable across the species range (Tapley et al. 2000, Tapley et al. 2010). An important challenge for managers is to select a harvest regime that optimizes hunting opportunities of local sportsmen without negatively affecting turkey populations, even in the face of growing hunting pressure. To meet this challenge successfully, it is important to understand how turkey populations are influenced by various harvest regimes. Historically, turkey populations are typically harvested under 1 of 3 regimes: 1) harvest of only males during spring, 2) harvest of males during spring with limited harvest of either sex during fall, or 3) a sustained-yield approach, with spring harvest of males and harvest of either sex during fall that allows for maximal harvest while still maintaining population viability (Healy and Powell 2000). Currently, Louisiana operates under the regime of male only harvest during spring. Because wild turkeys are polygynous and males do not contribute to young-rearing, this is often considered the most conservative harvest strategy as theoretically the removal of males should not impact population viability as severely as the removal of females.

Male survival is often observed to be lowest during the spring harvest season (Godwin et al. 1991, Ielmini et al. 1992, Paisley et al. 1995, Wright and Vangilder 2005), and numerous studies cite harvest as the leading source of male mortality (Godwin et al. 1991, Ielmini et al. 1992, Paisley et al. 1995, Humberg et al. 2009, Wright and Vangilder 2005). As such, even within the conservative approach of harvesting only males during spring, factors such as season length, bag limits, and hunter numbers can have substantial impacts on male survival, and consequently, on hunting quality when quality is defined by a large number of adult males in the hunted population and harvest. This was recently illustrated for a hunted population on public land (Ben's Creek WMA, hereafter BCWMA) in southeast Louisiana: survival estimates increased 94% for adults and 30% for juveniles when harvest regulations changed from a liberal season (≥23 days, 3-bird bag limit) to a more conservative strategy (≤23 days, 2-bird bag limit; Chamberlain et

al. 2012). Despite this increase, survival rates were still relatively low in comparison to other studies in the eastern turkey's range (Chamberlain et al. 2012). In contrast, mean annual survival of males on another parcel of public land (Sherburne WMA, hereafter SWMA) in south-central Louisiana, which operated under a strict harvest regime (lottery controlled 9-day season, 2-bird bag limit) was relatively high in comparison to other studies, with ≤15% of marked individuals harvested (Grisham et al. 2008).

We estimated survival and recovery based on 11 years of banding and recovery data concentrated on private lands in north-central Louisiana. The harvest regime during our study was intermediary to the conservative and liberal seasons for the public land study described in Chamberlain et al. (2012), with season length ranging from 23–30 days and a 2-bird seasonal bag limit. Our results, when compared to the results of Grisham et al. (2008) and Chamberlain et al. (2012) will provide insight into the influence of season length, bag limits, and hunter access on survival and recovery of male wild turkeys over a range of harvest strategies on both public and private lands in Louisiana. We hypothesized that survival rates would be higher and recovery rates lower than those estimated during either of the harvest strategies implemented at BCWMA (Chamberlain et al. 2012) because the restricted access associated with private lands should lead to reduced hunting pressure. We expected survival to be closer to that observed on SWMA, a public area with strict limits on hunter numbers, a short season, and low bag limits (Grisham et al. 2008)

Study Area

The study was conducted primarily on private lands in Union, Jackson, Bienville, and Lincoln parishes in north-central Louisiana. The study area was located in the southern coastal plains region, with study sites dominated by loblolly pine (*Pinus taeda*) plantations managed for wood fiber production. Stand rotations on plantations were typically <30 years; remaining cover types in the study area included older pine and mixed hardwood forest and grazed pasture. Hardwood stands were primarily associated with stream-side riparian areas. Landowners throughout our study area (primarily PlumCreek and Weyerhaeuser companies) leased parcels of land to private hunting clubs who often maintained small food plots aimed at providing forage for white-tailed deer (*Odocoileus virginianus)* and wild turkey.

Methods

We live trapped turkeys from late January – early March during 2002–2009 using rocket nets. Most trap sites were located on private hunting leases, although we also trapped birds on wildlife management areas immediately adjacent to targeted private lands. We banded each captured male with a uniquely numbered aluminum leg band (either butt-end or rivet) that contained contact information for the Louisiana Department of Wildlife and Fisheries (LDWF). We aged birds (juvenile and adult) based on size, spur length, and feather characteristics of the ninth and tenth primaries (Pelham and Dickson 1992). We released all birds at the capture site immediately following processing.

We stopped banding birds in 2009, but band recoveries continued through the 2012 hunting season. The length of the spring hunting season changed during our study. Season length was 23 days from 2002–2006, and increased to 30 days for 2007–2012. The bag-limit remained constant at 2 birds per hunter per season. The season opened on the fourth weekend of March for all years except 2010 and 2011, when it opened on the third weekend. Season timing was set by LDWF to act as a compromise between a conservative April start later in the nesting season, and the desires of hunters for an early season opening. Hunters were asked to report the harvest of banded birds to LDWF.

We grouped each banded male into one of two age classes; juvenile or adult. We used the band recovery model (Brownie et al. 1995) in program MARK (White and Burnham 1999) to model harvest data and to determine the best fit model parameters for survival (ϕ) and recovery (p) estimates. We applied four candidate models to determine the effects of age and year on survival and recovery. Models included combinations of survival and recovery parameters that either varied by, or were held constant across, age groups. For analysis that involved age dependence, we constructed age models in MARK to designate that after one year juvenile cohorts were recruited into the adult population. We selected the best-fitting model based on Akaike's information criterion adjusted for small sample sizes (AICc), Akaike weights (w_i), and model deviance (Burnham and Anderson 2002).

Results

We banded 261 male wild turkeys during 2002–2009, and recovered 91. We captured more juveniles ($n = 148$) than adults ($n = 113$), but marked adults were harvested in greater numbers ($n = 80$ adults and 11 juveniles). Based on AICc, ΔAICc, and w_i values, the most parsimonious model had both survival and recovery vary by age (Table 1). Survival of juveniles was almost twice that of adults, with estimated mean annual survival rates for juveniles and adults 0.55 and 0.30, respectively (Table 2). Band recovery rates were greater for adults than juveniles, with estimated recovery rates of 0.28 and 0.07 for adults and juveniles, respectively (Table 2). Direct recovery rates (percentage of individuals banded in winter recovered in the subsequent hunting season) of adults during 2002–2006 when the season length was 23 days averaged

Table 1. *A priori* list of candidate models used to model survival (ϕ) and recovery (*p*) for adult and juvenile wild turkey males in north-central Louisiana, 2002–2012. For each model we report the number of estimable parameters (K), Akaike's Information Criteria adjusted for small sample sizes (AICc), difference in AICc relative to smallest value (ΔAICc), Akaike weights (w_i), and deviance (DEV).

Model	K	AICc	ΔAICc	w_i	DEV
ϕ(a) *p*(a)[a]	4	528.46	0	0.88	98.52
ϕ(.) *p*(a)	3	532.54	4.08	0.12	104.66
ϕ(a) *p*(.)	3	549.92	21.45	0.00	122.03
ϕ(.) *p*(.)	2	553.84	25.38	0.00	128.01

a. Model parameters varied by age class (a), or were held constant across age classes (.).

Table 2. Survival and recovery rate estimates (with SE and 95% CI) for adult and juvenile male turkeys on public land in north-central Louisiana, 2002–2012, along with similar estimates from Ben's Creek WMA (BCWMA) in southeast Louisiana from 1989–2007 taken from Chamberlain et al. 2012.

Age class	Survival	SE	95% CI	Recovery	SE	95% CI
N. Lousiana[a]						
Adult	0.30	0.04	0.22 – 0.40	0.28	0.04	0.22 – 0.36
Juvenile	0.55	0.10	0.35 – 0.74	0.07	0.02	0.04 – 0.13
BCWMA: liberal[b]						
Adult	0.16	0.05	0.08 – 0.28	0.75	0.05	0.63 – 0.84
Juvenile	0.43	0.05	0.34 – 0.52	0.63	0.04	0.54 – 0.71
BCWMA: conservative[c]						
Adult	0.31	0.05	0.23 – 0.40	0.61	0.04	0.52 – 0.69
Juvenile	0.56	0.05	0.46 – 0.66	0.48	0.05	0.39 – 0.57

a. Season length: 23–30 days, 2-bird bag limit.
b. Season length 23–37 days, 3-bird bag limit.
c. Season length 16–23 days, 3-bird bag limit.

Table 3. Direct recovery rates and season length for male wild turkeys banded on private land in north-central Louisiana, 2002–2009.

Year	Adult	Juvenile	Season length (d)
2002	21.43	3.13	23
2003	16.67	11.11	23
2004	9.10	4.55	23
2005	25.00	NA	24
2006	27.78	16.67	23
2007	40	0	30
2008	36.36	12.5	30
2009	57.14	0	30

20% (range 9%–27.8%,) and increased to 44.5% (range 36.4%–57.1%) during 2007–2009 when the season length increased to 30 days (Table 3). Direct recovery rates of juveniles during the 23-day season averaged 8.7% (range 3.1%–16.7%) and 4.2% (range 0%–12.5%) during the 30-day season (Table 3). In years with 23-day seasons, 42.1% of recoveries were reported during the first week of the season, 35.1% for the second week, and 22.8% for the third. In years with 30-day seasons, 44.2% of recoveries were reported during the first week, 4.7% during the second, 25.6% during the third, and 25.6% during the fourth.

Discussion

We found survival and recovery estimates differed substantially between adults and juveniles, with juvenile survival almost twice that of adult survival. This discrepancy in survival between age classes is often reported (Vangilder 1992, Ielmini et al. 1992, Hubbard and Vangilder 2005, Wright and Vangilder 2005) and likely results from a combination of behaviors exhibited by turkeys and hunters; adult birds are considered more desirable to hunters, and adult birds generally gobble more than young birds, and are more susceptible to spring hunting (Vangilder 1992). Recovery rates for juveniles in this study were 85% and 89% lower than those observed during the conservative and liberal seasons on BCWMA (Table 2). It is possible this is an artifact of the culture associated with hunting on private vs. public land. On private land with little outside hunting pressure, hunters may be more likely to pass on harvesting a juvenile than a counterpart on public land. The reasoning being that on private land a hunter may feel that the lack of competition will provide ample opportunities to harvest an adult bird. Additionally, it is possible that individual hunting clubs implement their own internal rules restricting harvest of juveniles.

As expected, overall recovery rates were markedly lower, and the total percentage of bands recovered (34.7%) considerably less than that observed during either the liberal or conservative hunting season on BCWMA (Chamberlain et al. 2012). This finding is not particularly surprising as pressure on private lands would be expected to be less than that on public land with open hunter access. Survival estimates in our study for both adults and juveniles, despite much lower hunting pressure, were similar to BCWMA during the conservative season (Table 2). We expected to find that the restricted number of hunters on our study area and the resulting lower hunting pressure would lead to comparatively greater survival. Based on radio-telemetry data, Hubbard and Vangilder (2005) observed greater harvest mortality of males in an area with unlimited public access compared to an area with controlled hunter access, but annual survival between areas was not significantly different. We observed similar results.

Survival in this study was lower than that estimated from a combination of banded and radio-marked males on SWMA (Grisham et al. 2008) in south-central Louisiana. Harvest on SWMA was highly regulated, with a 9-day season, a lottery system to control hunter numbers, and a 2-bird seasonal bag limit. Grisham et al. (2008) reported an estimated mean annual survival rate for male turkeys of 0.64, with ≤15% of all marked birds harvested. Several factors likely accounted for the lower harvest mortality observed on SWMA. First, SWMA encompassed a large area (17,243 ha) with limited road access, thus there are large portions of the WMA where turkeys can avoid hunters. Additionally, the

nature of the lottery system ensures that only a small number of hunters are allowed access at any given time; 150 hunters drawn per day for five days, with the remaining four days open to the public (Grisham et al. 2008). This along with the short season also reduces the possibility of any one hunter harvesting more than a single bird. In contrast, while hunter access on our study area was primarily limited to members of hunting clubs, these members had ready access to large portions of the properties they leased and were able to hunt over several weeks in order to fill the 2-bird bag limit.

Although sample sizes and low recovery rates did not allow us to include models in which survival and recovery parameters varied by year, we did observe that the direct recovery rates of adults increased when the hunting season was extended from 23 days to 30 days (Table 3). Hubbard and Vangilder (2005) observed a similar increase in human-related mortality when season length increased from 2 to 3 weeks in Missouri. While most recoveries were reported during the first week of the hunting season, males were harvested consistently throughout the season regardless of season length. This contrasts the observations of Hubbard and Vangilder (2005), who reported >95% of human-related mortality in Missouri to occur during the first two weeks of a three-week season. The ability of hunters on our study area to consistently harvest birds during latter parts of the season likely played a role in the observed increase in direct recovery rates when the season was lengthened. Additionally, we used rivet bands with greater frequency in the later years of our study. While rivet bands are essentially permanent markers, retention rates of butt-end bands between the winter trapping season and the following hunting season has been estimated at 79%–96% (Diefenbach et al. 2009). As such, it is possible that we underestimated direct recovery rates in early years of our study due to band loss prior to hunting season.

In model simulations, Vangilder and Kurzejeski (1995) observed that as harvest of males increased the proportion of adults in the pre-hunt population as well as in the harvest decreased. They determined that harvest rates above 30%–35% would lead to sufficient enough decreases in the adult population to negatively affect hunting quality; where hunting quality was defined by a large number of adult males in the hunted population and harvest. Harvest rates on our study area approached this tipping point, hence we suspect that hunting quality could have declined during our study. However, the low harvest of juveniles we observed, combined with the fact that male survival during non-hunting portions of the year is often reported to be very high (>0.80; Godwin et al. 1991, Paisley et al. 1995, Wright and Vangilder 2005) suggests that a large portion of the juvenile cohort was recruited into the adult population each year. We believe that this worked to maintain hunting quality in terms of providing an adequate population of adults each season.

Management Implications

We found male survival rates on private land to be lower than we had expected given the associated limited hunter access. Additionally, recovery estimates were close to the harvest rate identified by Vangilder and Kurzejeski (2005) as the point when hunting quality would be expected to decline. Considering direct recovery rates for adults increased following an increase in season length from 23 to 30 days, we recommend that managers looking to reduce harvest levels as a means of ensuring quality hunting on private land consider modifications to season length as a viable management option. This may be particularly effective in areas where harvest rates are relatively consistent through the hunting season as opposed to concentrated during the opening week.

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