

# Deer Harvest Characteristics During Compound and Traditional Archery Hunts

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*Abstract:* Resource managers require accurate estimates of hunter success rates with various weapon types to predict annual harvests and design management strategies. We obtained harvest data for white-tailed deer (*Odocoileus virginianus*) on the McAlester Army Ammunition Plant in southeastern Oklahoma during periods of compound (1983–1988) and traditional archery (1989–1995) hunting to compare hunter success rates and the sex and ages of deer harvested. Hunter success was greater ( $P = 0.001$ ) with compound ( $\bar{x} = 17.8\%$ ;  $SE = 1.3$ ) than traditional archery equipment ( $\bar{x} = 10.7\%$ ;  $SE = 0.9$ ). Total harvest ( $P = 0.002$ ), number of bucks harvested ( $P = 0.001$ ), and number of does harvested ( $P = 0.027$ ) was also greater during compound archery hunts. Deer population estimates ( $P = 0.484$ ) and fawn:doe ratios ( $P = 0.148$ ) were not different between periods of compound and traditional archery. The replacement of compound with traditional archery hunts may allow managers to increase the proportion of mature bucks in the population by reducing harvest rates while maintaining recreational opportunities for hunters and associated economic benefits.

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The McAlester Army Ammunition Plant (McAAP) in southeastern Oklahoma is managed for quality white-tailed deer and is gaining recognition as one of the

premier deer hunting areas in the nation. The goal of managers at the McAAP is to reduce harvest rates of male deer, thereby allowing a greater proportion of older males in the population and increasing the overall age structure of the herd. The McAAP has held archery hunts since 1966, but has restricted harvests to traditional archery equipment (recurve and longbow) since 1989. These management decisions were originally employed to reduce hunter success rates and perceived selectivity, thereby decreasing buck mortality and increasing the proportion of older males in the population without reducing recreational opportunities for hunters. However, the efficacy of these harvest restrictions was unknown due to limited information on how weapon type influences herd demographics. With the exception of Gladfelter et al. (1983), who estimated hunter success with compound and other bow types using a mail survey approach, estimates of hunter success with various weapon types are not available in the literature. Most of the information that is available must be inferred from statewide harvest statistics (Roseberry and Woolf 1991), which commonly fail to accurately assess hunter effort (Weber et al. 1966), an essential statistic for estimating success.

Detailed harvest records collected before and after implementation of the archery restrictions were used to evaluate the efficacy of this strategy. Our specific objectives were to: (1) compare success rates of hunters using compound and traditional archery equipment, and (2) evaluate sex and age characteristics of deer harvested by each weapon type. We hypothesized that mature male deer would be less susceptible to hunters using traditional archery equipment due to decreased selectivity by traditional archers, and reduced range and accuracy of traditional archery equipment.

## Methods

The study was conducted at the McAAP, which is an 18,212-ha ammunition production and storage facility owned and operated by the U.S. Department of Defense in Pittsburg County, Oklahoma. Vegetation of the area has been described as tallgrass prairie (60%) interspersed with post oak (*Quercus stellata*)-blackjack oak (*Q. marilandica*) forest (40%) (Duck and Fletcher 1943). Dominant tree species were oaks, and browse species included greenbriar (*Smilax bona-nox*), buckbrush (*Symphoricarpos orbiculatus*), winged elm (*Ulmus alata*), sand plum (*Prunus angustifolia*), and persimmon (*Diospyros virginiana*). Native prairie grasses included broomsedge bluestem (*Andropogon virginicus*), big bluestem (*A. gerardii*), little bluestem (*Schizachyrium scoparium*), and panicums (*Panicum* spp.).

Harvest data were collected during the regular statewide archery season, October–November, 1983 to 1995. Hunting permits were allocated by lottery, and individual hunters could hunt only 1 weekend per year, but were allowed to harvest 2 deer of either sex. Prior to 1991, hunting was limited to 5 3-day hunts annually, and was expanded to 6 3-day hunts thereafter. Hunting was open to compound archery prior to 1989, and only a small proportion (<5%) of hunters chose to hunt with traditional archery equipment. In addition, 2 2-day antlerless shotgun hunts (approximately 150 hunters total) following the archery hunts were conducted annually to maintain population density. All harvested deer were returned to a check station where

sex and age were recorded. Deer ages were estimated from tooth replacement and wear (per Severinghaus 1949). Deer census counts were conducted during February of selected years (1982–1985 and 1993–1994) to obtain relative counts and establish population trends. Census counts were conducted by driving previously established routes of the area with 2 observers and counting the number of deer observed in each of 2 habitat types (upland hardwood forest and prairie meadow). The same route was driven during each census. Counts in each habitat type were adjusted because of disproportionate visibility. Fawn:doe ratios were estimated by obtaining observations of >400 does during August (1983–1995).

Total harvest, males in the harvest, proportion of males in the harvest, females in the harvest, number of hunters, and hunter success were compared between traditional (1989–1995) and compound archery hunts (1983–1988) using a Mann-Whitney test. Hunter success was calculated by dividing the number of deer harvested by the total number of hunters for that year. To test for changes in the proportion of male deer of different age classes (0.5, 1.5, 2.5, and  $\geq 3.5$  years of age) harvested during compound and traditional archery hunts, we compared the total number of males of each age class harvested between weapon types using Chi-square tests and Bonferroni  $z$  statistics as described by Neu et al. (1974). Deer census counts and fawn:doe ratios were compared between periods of compound and traditional archery with a Mann-Whitney test.

## Results

Total annual harvest ranged from 72 deer in 1989 to 313 in 1987 ( $\bar{x} = 183$ ; SE = 17), and number of harvested males ranged from 40 to 168 ( $\bar{x} = 104$ ; SE = 9) (Table 1). Number of hunters remained rather stable during this period, ranging from 1,124 to 1,473, and did not differ between compound and traditional hunts ( $P = 0.700$ ). Mean annual harvest ( $P = 0.002$ ) and mean annual harvest of males ( $P = 0.001$ ) were lower during traditional hunts compared to compound archery hunts. However, proportion of males in the harvest remained unchanged after the switch from compound to traditional archery equipment ( $P = 0.440$ ). Overall hunter success (bucks and does included) declined ( $P = 0.001$ ) after switching from compound ( $\bar{x} = 17.8\%$ ; SE = 1.3) to traditional archery equipment ( $\bar{x} = 10.7\%$ ; SE = 0.9). The proportion of 0.5, 1.5, 2.5, and  $\geq 3.5$  year-old bucks harvested was not influenced ( $P > 0.05$ ) by weapon type (Table 2), although when males  $\geq 1.5$  years of age were combined into 1 group, a greater number were harvested ( $P < 0.05$ ) with traditional archery equipment. Deer census counts ( $P = 0.484$ ) did not change between periods of compound ( $\bar{x} = 2111$ ; SE = 331) and traditional archery ( $\bar{x} = 1728$ ; SE = 63). Fawn:doe ratios ( $P = 0.148$ ) remained stable during compound ( $\bar{x} = 45.8$ ; SE = 5.6) and traditional archery ( $\bar{x} = 35.0$ ; SE = 3.5).

## Discussion

The original management goal of reducing hunter success rates and number of bucks harvested at the McAAP, without reducing the number of recreational

**Table 1.** White-tailed deer harvest statistics during compound and traditional archery hunts for the McAlester Army Ammunition Plant in southeastern Oklahoma 1983–1995.

| Year                       | Total harvest | Males | % Males | Females | Hunters | Hunter success |
|----------------------------|---------------|-------|---------|---------|---------|----------------|
| <b>Compound archery</b>    |               |       |         |         |         |                |
| 1983                       | 233           | 129   | 55.4    | 104     | 1,327   | 17.6           |
| 1984                       | 187           | 114   | 61.0    | 73      | 1,158   | 16.2           |
| 1985                       | 209           | 141   | 67.5    | 68      | 1,320   | 15.8           |
| 1986                       | 227           | 146   | 64.3    | 81      | 1,305   | 17.4           |
| 1987                       | 313           | 168   | 53.7    | 145     | 1,290   | 24.3           |
| 1988                       | 216           | 102   | 47.2    | 114     | 1,380   | 15.7           |
| $\bar{x}$                  | 231           | 133   | 58.2    | 98      | 1,297   | 17.8           |
| SE                         | 18            | 10    | 3.1     | 12      | 30      | 1.3            |
| <b>Traditional archery</b> |               |       |         |         |         |                |
| 1989                       | 72            | 40    | 55.6    | 32      | 1,135   | 6.3            |
| 1990                       | 118           | 67    | 56.8    | 51      | 1,124   | 10.5           |
| 1991                       | 166           | 91    | 54.8    | 75      | 1,250   | 13.3           |
| 1992                       | 175           | 102   | 58.3    | 73      | 1,390   | 12.6           |
| 1993                       | 135           | 71    | 52.6    | 64      | 1,473   | 9.2            |
| 1994                       | 181           | 91    | 50.3    | 90      | 1,426   | 12.7           |
| 1995                       | 149           | 91    | 61.1    | 58      | 1,468   | 10.2           |
| $\bar{x}$                  | 142           | 79    | 55.6    | 63      | 1,323   | 10.7           |
| SE                         | 14            | 8     | 1.4     | 7       | 58      | 0.9            |
| $P^a$                      | 0.002         | 0.001 | 0.440   | 0.027   | 0.700   | 0.001          |

\*Comparisons were made between periods of traditional and compound archery hunts using a Mann-Whitney test.

**Table 2.** Number of male deer harvested by age class during compound (1983–1988) and traditional (1989–1995) archery hunts at the McAlester Army Ammunition Plant in southeastern Oklahoma.

| Age  | Compound archery |           |      | Traditional archery |           |      | 95% Confidence interval for traditional harvest proportion <sup>a</sup> | Compound archery proportion ( $P$ ) <sup>b</sup> |
|------|------------------|-----------|------|---------------------|-----------|------|---|--|
|      | <i>N</i>         | $\bar{x}$ | SE   | <i>N</i>            | $\bar{x}$ | SE   |   |  |
| 0.5  | 202              | 33.7      | 6.29 | 86                  | 2.3       | 1.81 | 0.057 ≤ $P$ ≤ 0.253   | 0.253  |
| 1.5  | 297              | 49.5      | 4.61 | 216                 | 30.9      | 5.15 | 0.308 ≤ $P$ ≤ 0.474   | 0.371  |
| 2.5  | 84               | 14.0      | 1.93 | 105                 | 15.0      | 3.28 | 0.094 ≤ $P$ ≤ 0.286   | 0.105  |
| ≥3.5 | 217              | 36.2      | 2.87 | 146                 | 20.9      | 1.71 | 0.173 ≤ $P$ ≤ 0.355   | 0.271  |

\*Confidence intervals are calculated based upon the number of males harvested in each age class using the Bonferroni  $z$  statistic as described by Neu et al. (1974).

<sup>b</sup>Proportion of males harvested.

participants (permits issued), was achieved by switching from compound to traditional archery weapon types. Consistency in deer census counts and fawn:doe ratios indicated that population density and fawn recruitment were relatively constant during the study period, suggesting that changes in hunter success were due to the switch from compound to traditional archery equipment. Hunter success declined by 65%

immediately following the switch from compound to traditional archery weapons, providing additional support to the conclusion that changes in hunter success were driven by weapon type. Gladfelter et al. (1983), utilizing a mail survey, also found decreased success for recurve ( $\bar{x} = 20.6\%$ ;  $SE = 1.7$ ) as opposed to compound archers ( $\bar{x} = 27.2\%$ ;  $SE = 0.9$ ), although success rates for both groups were greater than at the McAAP. This could be due to limited familiarity of hunters with the McAAP and restricted time afield (3 days) for McAAP hunters. Also, mail survey information tends to overestimate hunter success because successful hunters are more apt to return surveys than unsuccessful hunters (Barker 1991, Pendleton 1992). As a result, data gathered during this study may provide a more accurate estimate of average success of compound and traditional archers than estimates obtained from mailed questionnaires.

We had originally hypothesized that mature bucks ( $\geq 3.5$  years old) would be more susceptible to compound than traditional archers due to limitations (e.g., range and accuracy) associated with traditional archery equipment. However, the proportion of mature males in the harvest did not change with the switch to traditional archery hunts. Rather, the proportion of males  $\geq 1.5$  years old was greater during traditional as opposed to compound archery hunts. We attribute this to decreased hunter success and increased male survival during the period of traditional hunts, resulting in increased average age of males in the population, rather than increased susceptibility of older males to traditional archers.

Decreased hunter success rates due to traditional archery equipment may have important implications for deer herd managers. Recent trends towards quality deer management have required creativity in designing harvest strategies that will reduce buck harvests and allow more males to reach maturity. These goals can be accomplished either by reducing hunter success rates or limiting the number of hunters in an area. This study suggests that the substitution of traditional for compound archery equipment can reduce the number of bucks harvested without a comparable reduction in hunters. As a result, employment of a similar strategy could allow wildlife managers to successfully increase the proportion of mature males in the population while maintaining recreational opportunities for hunters and associated economic benefits.

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