

# MULE DEER ANTLER GROWTH AND HUNTING MANAGEMENT ON THE NORTH KAIBAB, ARIZONA

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## ABSTRACT

Mule deer (*Odocoileus hemionus*) management must be biologically sustainable and socially acceptable. Social expectations for hunter harvest and hunt quality often place greater restrictions on deer management than do biological limitations. The mule deer herd that inhabits the North Kaibab, Arizona (Game Management Unit 12A) is managed under Arizona Game and Fish Commission alternative deer-management guidelines that were designed to provide lower hunter densities, higher hunt success during late season hunts, and a greater opportunity to harvest an older age-class deer. I compared antler spread, antler points, and cementum age of mule deer bucks harvested on the North Kaibab from measurements taken at a mandatory hunter check station at Jacob Lake, Arizona. Mule deer antler points and antler spread increased with age to 5 years, after which antler points and spread did not substantially increase. Through a public process, the Arizona Game and Fish Commission established alternative deer management guidelines that included permit adjustments for late season hunts to ensure 55–75% of animals harvested were  $\geq 3$  years of age and 20–30% of the animals harvested were  $\geq 5$  years of age.

## INTRODUCTION

Setting hunting seasons and allowable harvest is an important aspect of wildlife management under the authority of state wildlife management agencies. Seasons and harvest are routinely based on biological data and social desires. For instance, research indicates that mule deer buck to doe ratios must drop below 4–7:100 before reproductive capability of the herd is limited biologically (White et al. 2001, Bishop et al. 2005). Harvest, therefore, should not reduce the number of bucks beyond the point at which reproduction is reduced to maintain or grow deer populations, and deer populations should be surveyed routinely to monitor their relative status. Hunters express interest in a wide variety of hunt types (Manfredo et al. 2004), yet vocal proponents are often interested in higher buck to doe ratios with fewer hunters (Bishop et al. 2005, Wakeling and Watkins in press). In other words, social restraints are generally greater than are biological restraints on hunting.

Because the hunting public desires differing types of opportunities, the Arizona Game and Fish Commission (Commission) has adopted two philosophically different sets of management guidelines by which mule deer hunts are developed: standard and

alternative management. The Commission is the five-member, policy-setting body for the Arizona Game and Fish Department (Department). Currently, all general-season opportunity is regulated through a lottery draw system. Units managed according to standard management guidelines adjust permits when post-season mule deer buck-to-doe ratios are beyond 10–20:100, fawn to doe ratios are beyond 40–50:100, measured hunt success is beyond 15–20%, or the population trend is not stable. Game Management Unit (Unit) 12A (East and West) encompasses the North Kaibab Plateau, Arizona, and is managed according to alternative deer management guidelines. Alternative deer management guidelines are designed to provide higher hunt success, lower hunter density, or a greater opportunity to harvest an older age-class buck. Alternative deer management guidelines include managing for buck to doe ratios up to 30:100, fawn to doe ratios up to 60:100, and provide for late season hunts that occur near the onset of the breeding season with low hunter densities.

Management of mule deer on the North Kaibab has often been controversial (Russo 1964, Swank 1998, Wakeling 2007). When several hunters expressed interest in introducing more restrictive guidelines during 2000 to ensure the quality of future harvests, the Department examined data and used a public input process before proposing amendments to the alternative management guidelines to the Commission. Hunters suggested that existing alternative guidelines, which included managing for a late season harvest that comprised 55–75%  $\geq 3$ -year-old deer with no guidance regarding older age class deer, did not always provide the trophy-quality deer the public expected. Russo (1964) had examined 3,124 mule deer and found the preponderance of deer with  $\geq 70$  cm outside antler spread were  $> 3$  years of age. Because Russo (1964) relied

on aging mule deer based on tooth eruption and wear patterns (Dimmick and Pelton 1996), he could examine relationships of antler growth only among broad age classes (e.g., 3–5 years). Because the Department had been collecting age data from harvested deer in some years during the late 1990s using cross sections of incisors and counts of cementum annuli (Dimmick and Pelton 1996), more precise age data was available to compare with antler growth measurements, which could then be used to evaluate existing hunt guidelines. Antler spread seemed to reach a maximum at five years of age, and the Commission ultimately adopted a guideline in 2001 that 20–30% of the late season harvest should comprise deer that were  $\geq 5$  years of age. My objective was to evaluate the effectiveness of the alternative deer management guidelines adopted by the Commission in 2001.

## METHODS

Mule deer harvested by hunters in Units 12AW and 12AE are legally required to be checked at the Jacob Lake hunter check station. Deer age was determined by tooth eruption patterns for deer up to three years of age or by removal of a middle incisor for sectioning and counting of cementum annuli for deer  $> 3$  years of age (Dimmick and Pelton 1996). Antler points were enumerated for each antler, and the outside spread of the antlers was measured and recorded.

To determine what constituted potential antler growth in Unit 12A, the Department examined mean antler spread and mean antler points/side by age. The assumption in this exercise is that a deer with wider antlers and more points constitute a more desirable harvest for hunters than do deer with narrow antlers and few points.

Public comment was sought on changes to the alternative management guidelines as well as any other proposed changes to hunt guidelines for fall 2001 through

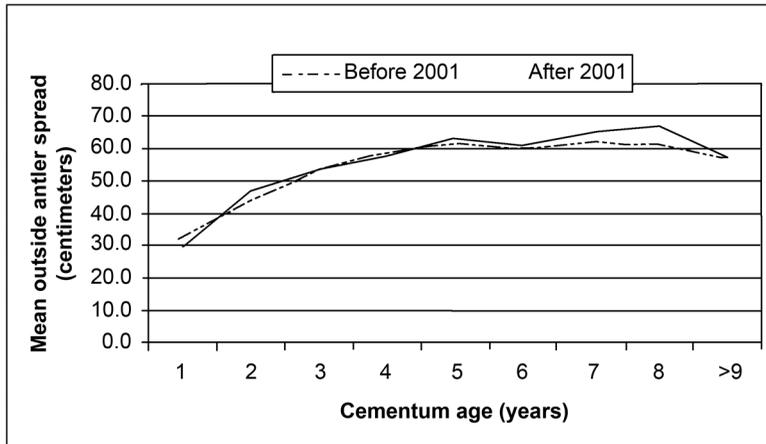


Figure 1. Mean outside antler spread (centimeters) for each age class of harvested mule deer (1995–2005) from Unit 12A, Arizona, before implementation and after implementation of amended alternative deer-management guidelines in 2001.

spring 2002. Eleven public meetings with more than 200 attendees were held in Flagstaff, Fredonia, Kingman, Payson, Pinetop, Phoenix, Prescott, Safford, Sierra Vista, Tucson, and Yuma, Arizona, during January and February 2001. During the same time frame, written comments could be submitted for consideration, and the Department received more than 150. Comments were compiled and shared with the Commission at the April 2001 meeting, where deer season hunt recommendations were adopted for fall 2001. Very few of the comments from the public meetings or written correspondence specifically addressed the amendments to the alternative deer management guidelines.

Alternative management guidelines for deer were amended in April 2001 to include two additional parameters: (1) 55–75% of the harvest in late season hunts would comprise deer  $\geq 3$  years of age and (2) 20–30% of the harvest in the late season hunts would comprise deer  $\geq 5$  years of age. Consequently, I compared mean antler data by age class before and after guideline change implementation graphically. I also examined age data from

harvests before and after implementation of amended guidelines, graphically and using chi square contingency tables (Zar 1984) to determine if differences in composition of the harvest could be detected. In addition, I examined the approved permit allocations before and after implementation of the amended guidelines.

## RESULTS

I analyzed measurements from 1,794 male mule deer harvested in Unit 12A during 1995, 1996, 1998, 2003, 2004, and 2005 (908 before 2000, 846 after 2002). Maximum mean antler width and points/side were effectively achieved by the time a deer reached five years of age (Figures 1, 2). Mean antler points/side by age and mean outside spread by age had similar distributions both before and after implementation of amended alternative deer-management guidelines on the North Kaibab (Figures 1, 2). Because so few deer are harvested in older age classes (Figure 3), a single eight-year-old deer with multiple antler points in 2006 resulted in a peak in that age class (Figure 2).

Minor shifts have been observed in

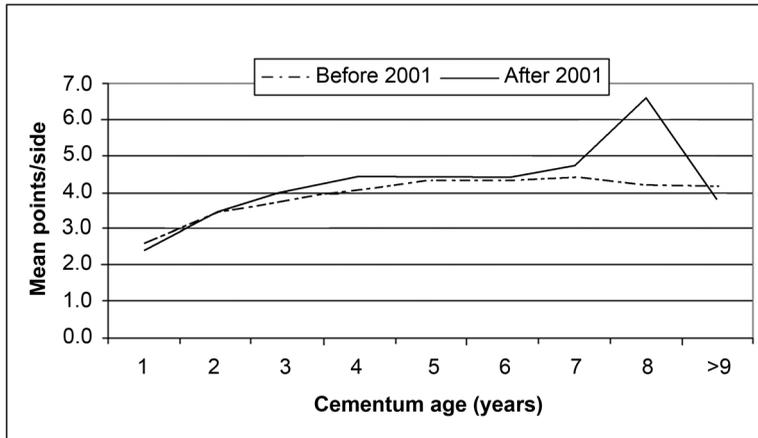


Figure 2. Mean antler points/side for each age class of harvested mule deer (1995–2005) from Unit 12A, Arizona, before implementation and after implementation of amended alternative deer-management guidelines in 2001.

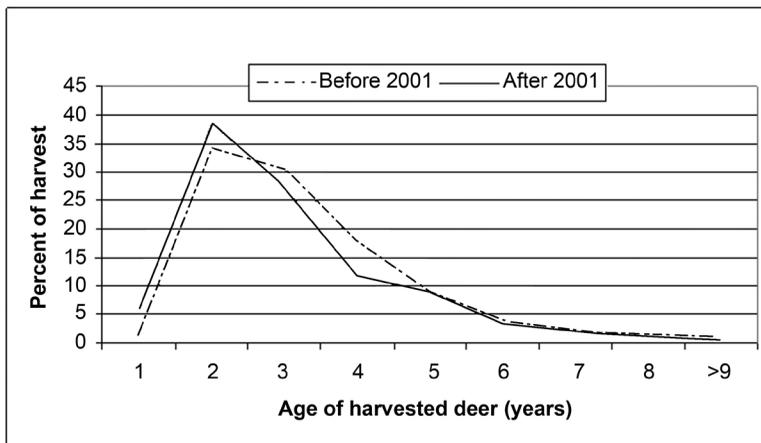


Figure 3. Age classes of mule deer as a percentage of harvest from all hunts (1995–2005) in Unit 12A, Arizona, (not only late hunts) before and after implementation of amended alternative management guidelines in 2001.

the composition of the harvest since implementation of the amended alternative guidelines in 2001. During the late hunts before 2001, 67% of the harvest comprised deer  $\geq 3$  years of age and 18% of the harvest comprised deer  $\geq 5$  years of age. Since 2001, the late hunts comprised 71% of the harvest from deer  $\geq 3$  years of age and

28% from deer  $\geq 5$  years of age. In the late hunts, proportionally fewer younger deer, more deer  $> 3$  years of age ( $\chi^2_c = 13.367$ , 1 df,  $P < 0.007$ ), and more deer  $> 5$  years of age ( $\chi^2_c = 17.87$ , 1 df,  $P < 0.001$ ) have been harvested since 2001 (Figure 4).

Permit levels were somewhat greater in the five years prior to implementation

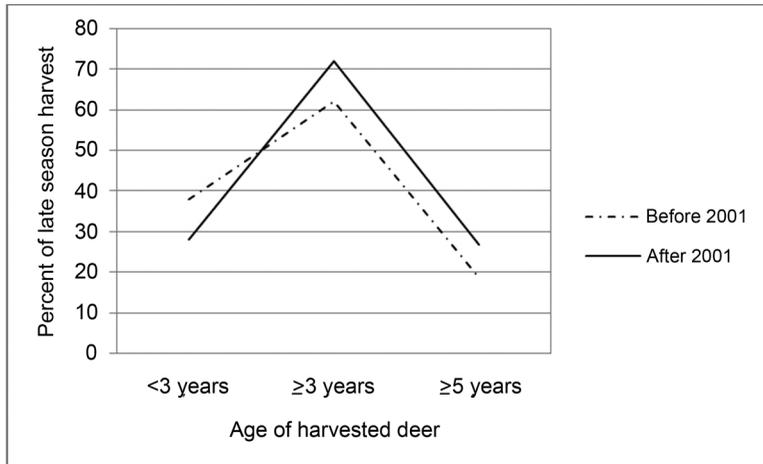


Figure 4. Percent of deer by age class harvested during the late season (1995–2005) in Unit 12A, Arizona, before and after implementation of the amended alternative management guidelines in 2001.

of amended alternative deer-management guidelines than in the five years after implementation. During early hunts, approved Unit 12A permits ranged from 1,100 to 1,400 before implementation, whereas approved early hunt permits ranged from 425 to 1,200 after implementation. Approved late hunt permits ranged from 200 to 300 before implementation and 150 to 225 afterward. Hunter success remained high (>50%) during all late season hunts across all years.

### DISCUSSION

Using a public process, the Department was able to determine what a critical segment of the hunting customers desired in a region of the state. By coupling social desires with biological data, the Department was able to propose amended guidelines that were largely supported by the public and attainable without placing unreasonable restrictions on hunting opportunity. Relatively minor adjustments to the number of recommended permits during late season hunts (total permits in these hunts are generally between 200 and 250) allow the Department to maintain hunt

quality in late hunts, while still providing hunters with greater numbers of permits in early hunts in Unit 12A.

Maximum mean outside antler spread of 64 cm is achieved by 5 years of age, although a small increase seems to occur during the seventh year. In fall 2007, a deer that measured >100 cm outside spread was inspected at the check station, although no data is yet available on the cementum age of the deer. A substantial proportion of the antler growth occurs by three years of age. This growth pattern is generally in agreement with that found by Russo (1964) and Anderson and Medin (1969). According to hunt guidelines, permit levels were influenced by population level and buck-to-doe ratios during early hunts, whereas late hunt permit levels were more influenced by harvest composition and population level.

Managing deer hunts with these metrics requires the acquisition of harvested deer teeth for sectioning and cementum-aging to determine precise ages; using tooth eruption would require broader categories in hunt guidelines. To acquire incisors, substantial effort through check stations or field

checks is required to obtain a statistically valid sample. In practice, managing deer herds conservatively, hence further from the biological limitations, is often more costly to monitor because of public interest and scrutiny, although this costly effort is less critical or necessary in monitoring the biological status of the deer herd. Because the herds we monitored on the Kaibab are managed more conservatively, less revenue for the State and wildlife management is derived from them than could be realized on a more intensively managed herd, and fewer hunters are afforded the chance to participate in hunting in conservatively managed areas.

Arizona's mule deer management is largely successful in Unit 12A with few hunters voicing complaints about the quality of deer being harvested during late hunts. Other issues remain contentious among hunters, land management agencies, and the Department, such as forage monitoring, female harvests, and population estimates (see Wakeling 2007). Amendments to alternative management guidelines have yielded increased proportions of older age-class animals in the harvest, which should reflect larger-antlered deer, while hunter opportunity has not been reduced on early hunts.

#### LITERATURE CITED

- Anderson, A. E., and D. E. Medin. 1969. Antler morphometry in a Colorado mule deer population. *Journal of Wildlife Management* 33:520–533.
- Bishop, C. J., G. C. White, D. J. Freddy, and B. E. Watkins. 2005. Effect of limited antlered harvest on mule deer sex and age ratios. *Wildlife Society Bulletin* 33:662–668.
- Dimmick, R. W., and M. R. Pelton. 1996. Criteria of sex and age. In *Research and Management Techniques for Wildlife and Habitats*. 5th edition, edited by T. A. Bookhout, pp. 169–214. The Wildlife Society, Bethesda, Maryland.
- Manfredo, M. J., P. J. Fix, T. L. Teel, J. Smeltzer, and R. Kahn. 2004. Assessing demand for big-game hunting opportunities: Applying the multiple-satisfaction concept. *Wildlife Society Bulletin* 32:1147–1155.
- Russo, J. P. 1964. The Kaibab North deer herd: Its history, problems, and management. *Wildlife Bulletin* 7. Arizona Game and Fish Department, Phoenix, Arizona.
- Swank, W. G. 1998. History of the Kaibab deer herd, beginning in 1968. In *Proceedings of the 1997 Deer-Elk Workshop*, Rio Rico, Arizona, edited by J. C. deVos, Jr., pp. 14–23. Arizona Game and Fish Department, Phoenix, Arizona.
- Wakeling, B. F. 2007. Wildlife management decisions and Type I and II errors. *Western States and Provinces Deer and Elk Workshop Proceedings* 6:35–42.
- Wakeling, B. F., and B. E. Watkins. In press. Mule deer hunting: Public attitudes and agency management. *Western States and Provinces Deer-Elk Workshop* 7.
- White, G. C., D. J. Freddy, R. B. Gill, and J. H. Ellenberger. 2001. Effect of adult sex ratio on mule deer and elk productivity in Colorado. *Journal of Wildlife Management* 65:543–551.
- Zar, J. H. 1984. *Biostatistical Analysis*. 2<sup>nd</sup> Edition. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

