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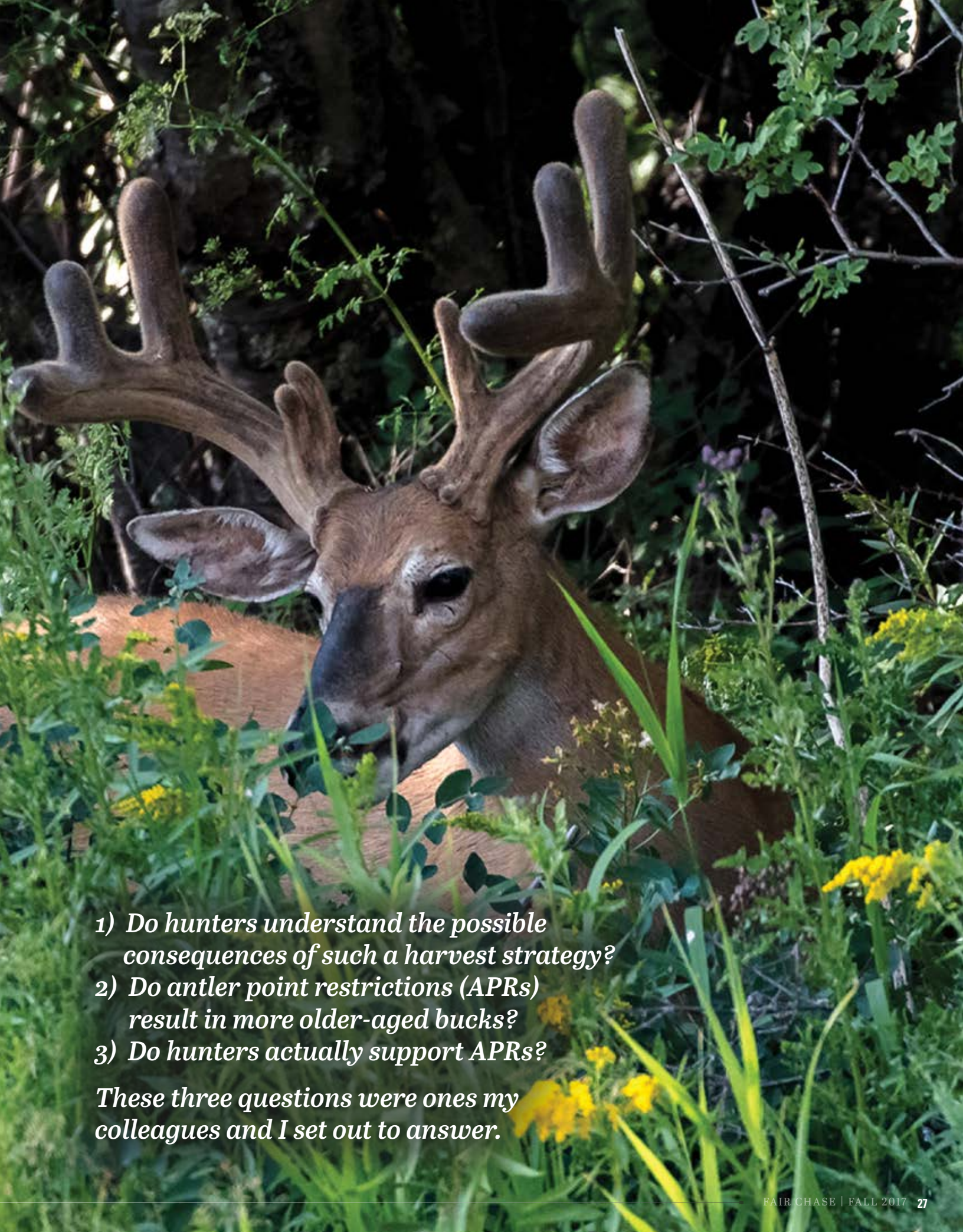
ANTLER POINT REGULATIONS:

Managing for biological success

The whitetail deer is an awe-inspiring species—beautiful, elegant, graceful. But if you are a hunter, there is no greater rival. Silent in their movement, invisible on the landscape—whitetails test us on every hunt. It may be the perfect quarry, biologically speaking, as well. With a polygamous breeding system and high reproductive rate, harvest regulations for males can be very liberal. Is there any greater challenge than hunting a whitetail buck on a crisp fall day? In Pennsylvania, about 1 million hunters agreed during the latter half of the 20th century that the purchase of a hunting license allowed them to harvest one antlered deer.

As a result of this intense hunting pressure, Pennsylvania hunters harvested 77 to 84 percent of their antlered deer population every year. We know this because Pennsylvania Game Commission personnel field-checked harvested deer during 1981-2001 and aged 315,175 antlered deer. Under the assumptions of a stationary population (little annual change in size or age structure) and that all age classes had the same harvest rate, the proportion of 1½-year-old deer in the harvest represents the harvest rate. But even if these assumptions were violated, the harvest rate was so high there was little resulting bias in these estimated harvest rates.

Every autumn the median age of bucks in Pennsylvania was 1½ years old. The odds of living to 3½ years old? Not good (less than 5 percent). Given that a whitetail deer buck is not considered physically mature until 5 or 6 years of age, antler size of Pennsylvania deer was rarely something to write home about.



1) Do hunters understand the possible consequences of such a harvest strategy?
2) Do antler point restrictions (APRs) result in more older-aged bucks?
3) Do hunters actually support APRs?

These three questions were ones my colleagues and I set out to answer.

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So how can you lower the harvest rate of bucks so that more bucks survive into older age classes? There are multiple ways, but it basically comes down to two strategies: limit the number of hunters or restrict the types of bucks legal for harvest. The former is definitely going to make some hunters very unhappy, especially if the status quo was that anyone with a hunting license had an opportunity to harvest a buck.

The latter strategy, involving some type of restriction on the definition of a legal buck for harvest, is likely a more socially acceptable policy. Restrictions include setting a minimum spread of the antlers, or minimum number of points, or a combination of both. These strategies have been implemented in such states as Mississippi and Texas. The simplest strategy of having to count the number of points to determine legality leads to fewer mistakes on the part of hunters.

In 2002, the Pennsylvania Game Commission (PGC) implemented antler point restrictions (APRs) for whitetail deer. Depending on the management unit, bucks were not legal for harvest unless they had three or four points on one side. The main beam was considered a point as was a brow tine or any other point that was at least 1-inch long.

So did everyone live happily ever after once the age (and antlers!) of Pennsylvania bucks increased from APRs?

The fairy tale of APR acceptance (and results) doesn't happen overnight. In 1987, Len Carpenter and Bruce Gill wrote a paper titled "Antler Point Regulations: The Good, the Bad, and the Ugly." Carpenter and Gill argued that before an agency embarks on implementing such regulations there are three issues that need to be addressed:

1) Do hunters understand the possible consequences of such a harvest strategy?

2) Do APRs result in more older-aged bucks? (Specifically, do hunters comply with the regulations, and if so, do those bucks not harvested survive to the next hunting season?)

3) Do hunters actually support APRs?

These three questions were ones my colleagues and I set out to answer. The research we conducted is the only comprehensive evaluation of "The Good, the Bad, and the Ugly" of APRs. Increases in male-to-female ratios due to APRs have been documented in moose *(Alces alces)* and elk *(Cervus americanus)*, but survival and harvest rates of males were not monitored. Similarly, changes in the age structure of the harvest of whitetail deer where APRs were implemented have been documented, but whether these changes were due to increased survival rates and reduced harvest rates—or simply changes in the definition of bucks legal for harvest—is unknown.

However, before I get into the biological consequences of APRs and our evaluation, there are some other issues about managing deer in Pennsylvania that you need to understand. Pennsylvania deer management has always been and likely always will be controversial. The PGC was created in 1895 because of a scarcity of game, but by 1916 the director was promoting regular antlerless deer seasons. Antlerless deer seasons in Pennsylvania were sporadic, at best, for the next 40 years.

The adverse effects of deer browsing have been an issue in Pennsylvania since the early 20th century. The problem of deer browsing in Pennsylvania has been documented by studies and publications since the 1930s, including a mid-century report by Aldo Leopold documenting the problem with high deer densities throughout the United States. Despite the wildlife and forestry profession's recognition of the difficulty of managing deer populations in balance with habitat conditions, by the end of the 20th century Pennsylvania's deer population was 86 percent above the PGC's deer density goals.

In a survey I conducted in the 1990s, 57 percent of Pennsylvania hunters disagreed that damage to forests by deer was a problem and 24 percent did not believe there were enough deer unless some were starving to death each year. At the same time, research in Pennsylvania had shown that deer browsing changes the regenerating capacity of our forests, reduces abundance and diversity of the plant community, and that these effects result in long-term changes in plant and animal communities.

Consequently, the implementation of APRs by the PGC was not simply motivated by the desire to allow more bucks to reach an older age class, but rather to manage deer populations in balance with available habitat. That is, deer abundance in Pennsylvania needed to be reduced and APRs might be a way to achieve long-term changes in deer management. The million-dollar question was whether hunters would accept APRs and if the benefits of APRs were an acceptable trade-off for a reduced deer population.

With the implementation of APRs, the PGC was poised to conduct a major experiment: reduce harvest rates on bucks to increase the number of 2½-year-old and older animals and increase harvest rates on antlerless deer to reduce the overall deer population. Would it work?

To find out if APRs accomplished the desired changes in the buck population, we designed our research to be able to answer three questions:

1) Did hunters comply with APR regulations such that harvest rates were reduced from 80 percent to less than 50 percent for 1½-year-old bucks?

2) Once these bucks survived the hunting season, did they survive to be available for harvest the following year?

3) Did hunters harvest more older-aged bucks?

We monitored statewide deer harvests and conducted fieldwork in two wildlife management units (WMUs) in Pennsylvania—WMU 2D and 4D. Located in western Pennsylvania, WMU 2D has ideal deer habitat—the landscape is a mosaic of farmland and forest with productive soils. In this study area, about 40 percent of 1½-year-old bucks had at least four points on one antler, so four-point APRs were implemented. Under a four-point APR, 93 percent of older bucks were legal for harvest.

In central Pennsylvania where WMU 4D is situated, the landscape is forested along extensive, linear ridges dominated by less-productive soils derived from sandstone bedrock. Valleys soils were derived from limestone bedrock and much of the land was farmed or developed. In this study area, we predicted that a three-point APR would protect about 65 percent of 1½-year-old deer and that 80 percent of adult bucks would be legal for harvest.

Over a three-year period (2002-2004), we captured and radio-collared 556 bucks to monitor their survival and cause-specific mortality in both study areas. In hindsight, these captures alone told us a lot about how well APRs worked. In 2002, the winter before APR regulations were first implemented, we captured 10 eight-month-old bucks (that would be 1½ years old in fall 2002) for every adult buck—a 10-to-1 ratio. In 2003, that ratio declined to 9-to-1, and in 2004 our capture ratio declined to 2-to-1!

On both study areas we estimated that the harvest rate of 1.5-year-old bucks declined from 80 percent to 31 percent. Clearly APRs achieved their objective of reducing harvest rates. Of the 13 percent that were illegally killed, 3 percent were mistaken kills self-reported by hunters, which indicates the majority of hunters complied with the regulations *(Figure 1)*.

To our surprise, APRs also resulted in lower harvest rates for adult deer—59 percent, with only 6 percent illegally harvested. Even though 80 to 95 percent of bucks 2.5 years old or older were legal for harvest, more of them survived the hunting season. Requiring hunters to count antler points before pulling the trigger may have allowed more of these bucks to survive the hunting season *(Figure 2)*.

FIGURE 1. FATES OF 274 1½-YEAR-OLD BUCKS DURING HUNTING SEASON. The percentage of legally harvested does not match estimated harvest rates because this chart does not account for censored deer or changes in number of deer at risk over the course of the hunting seasons.

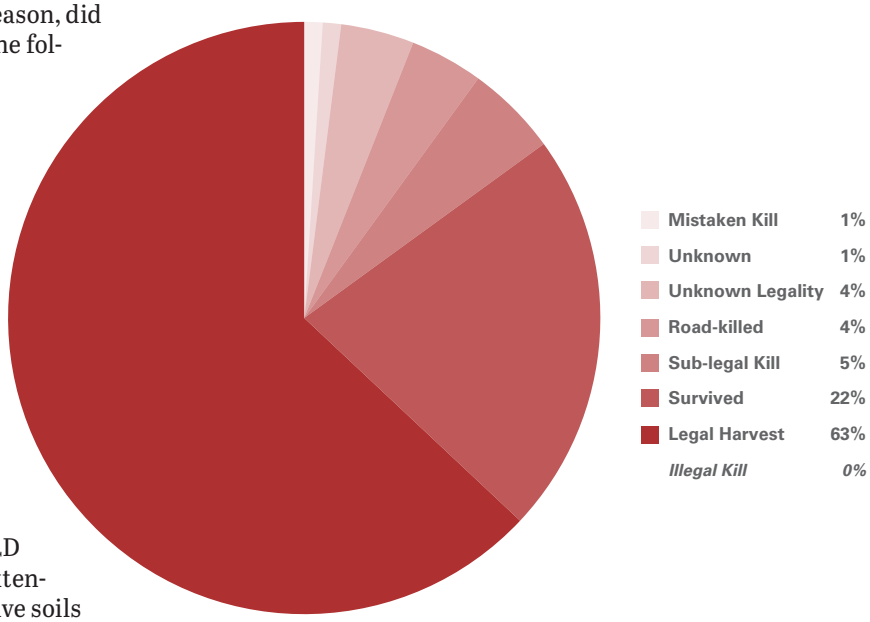
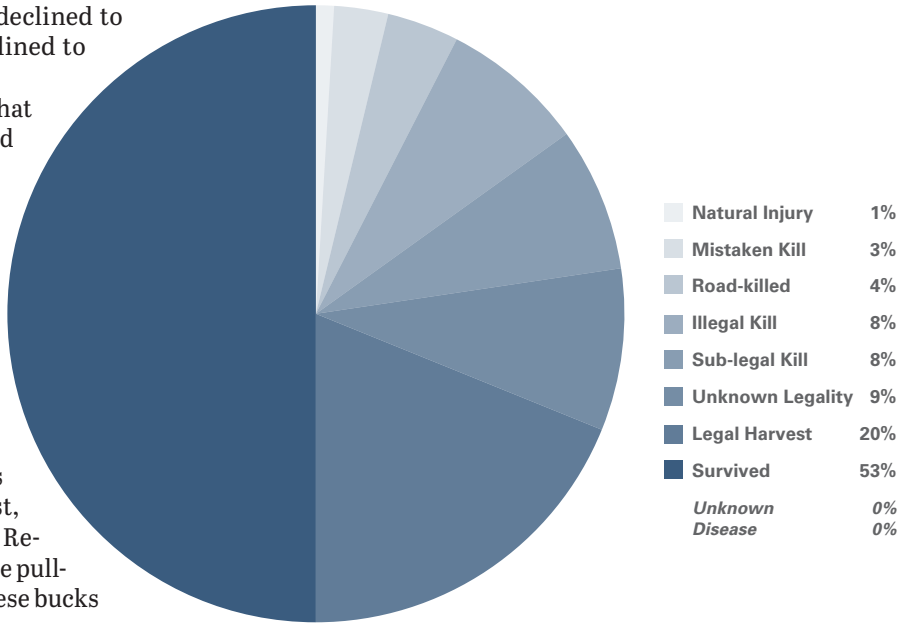


FIGURE 2. FATES OF 140 BUCKS 2½ YEARS OR OLDER DURING HUNTING SEASON. The percentage of legally harvested does not match estimated harvest rates because this chart does not account for censored deer or changes in number of deer at risk over the course of the hunting seasons.



Our research documented that APRs reduced harvest rates, but what about after the hunting season? Did those bucks that survived the hunting season make it to the next one? It turns out that 92 percent did. Survival was greater than 95 percent every month, and most of those mortalities were roadkills. The probability of being illegally killed was only 1 percent outside the hunting season.

Reduced harvest rates increased annual survival of bucks, which had a dramatic effect on the age structure of the population. Whereas fewer than 5 percent survived to age 3.5 before APRs, we estimated that after APRs were implemented, 11 percent of the population was more than 2½ years old *(Figure 3)*.

We estimated this age structure based on the harvest and survival rates we observed, but we also empirically verified the result. During the 2006 and 2007 hunting seasons, over 5,000 teeth from bucks age 2½ years or older were submitted to a laboratory and aged by sectioning the tooth and counting cementum annuli. These results confirmed that 11 percent of the harvest was 3½ years or older!

Now to answer the third question: did Pennsylvania hunters harvest more older-aged bucks? This might seem like a no-brainer given all the data I have shared, but remember that the agency also was increasing harvest rates on antlerless deer to reduce the overall population.

Between 2000 and 2005, statewide pre-hunt deer density declined from 32.3 deer per square mile to 24.7 deer per square mile—a 23 percent decline in deer density. During this same time period, the harvest of 1½-year-old bucks declined from 198,585 to 63,251 (a 68 percent decline!) while the harvest of 2½-year-old and older bucks increased from 42,579 to 56,864 deer—a 25 percent increase.

Biologically, APRs were successful because they reduced the harvest rate of bucks; 92 percent of those bucks survived to the following hunting season; hunters complied with APR regulations; and the end result was more, older bucks harvested by hunters despite the 23 percent reduction in deer density. But deer management is more than just meeting biological objectives.

Two of three concerns about APRs expressed by Carpenter and Gill were related to whether hunters understood and accepted APRs. Consequently, this experiment could have been completely successful from a biological standpoint but a management failure if the results were not acceptable to hunters. In the next issue of *Fair Chase*, I'll address the social outcomes of Pennsylvania's APR regulations. ■

REFERENCES AND SOURCES:

CARPENTER, L. H., AND R. B. GILL. 1987. ANTLER POINT REGULATIONS: THE GOOD, THE BAD, AND THE UGLY. TRANSACTIONS OF THE WESTERN ASSOCIATION OF GAME AND FISH COMMISSIONERS 67:94–107.

WALLINGFORD, B. D., D. R. DIEFENBACH, E. S. LONG, C. S. ROSENBERRY, AND G. L. ALT. 2017. BIOLOGICAL AND SOCIAL OUTCOMES OF ANTLER POINT RESTRICTION HARVEST REGULATIONS FOR WHITE-TAILED DEER. WILDLIFE MONOGRAPHS 196:1-26.

LEOPOLD, A., L. K. SOWLS, AND D. L. SPENCER. 1947. A SURVEY OF OVER-POPULATED DEER RANGES IN THE UNITED STATES. JOURNAL OF WILDLIFE MANAGEMENT 11:162–177.

DIEFENBACH, D. R., W. L. PALMER, AND W. K. SHOPE. 1997. ATTITUDES OF PENNSYLVANIA SPORTSMEN TOWARDS MANAGING WHITE-TAILED DEER TO PROTECT THE ECOLOGICAL INTEGRITY OF FORESTS. WILDLIFE SOCIETY BULLETIN 25:244–251.

Read the entire article "The Whitetail Rut in Pennsylvania," in the winter 2015 issue of Fair Chase online in the B&C Associates community.

FIGURE 3. Age structure of the antlered deer population before and after APR regulations were implemented in Pennsylvania.