

## **Biological and social implications of a 7-day concurrent firearms season**

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**ABSTRACT** In 2008, the Board of Game Commissioners modified the firearm season length for antlerless deer in Wildlife Management Units (WMU) 2D, 2G, 3C, and 4B from a 12-day concurrent antlered and antlerless season to a 5-day antlered followed by a 7-day concurrent antlered and antlerless season. We investigated potential biological and social implications that could occur due to this change to the firearms season using marked white-tailed deer and hunter surveys. Despite the study design, antlerless allocations were modified by the Board of Commissioners to allow deer populations to increase in each experimental WMU during this study. Additional changes were made to season length and antler point restrictions. Population increases confounded our ability to identify the direct effects of the 7-day concurrent firearms season on deer sightings, and other changes eroded our ability to assess study objectives. Even though deer populations increased, hunter surveys indicated no improvements in hunter activities and attitudes towards deer population abundance, hunting season regulations, or the deer management program. A number of negative consequences were identified including: 1) perpetuation of a false notion that too many deer are killed during a 12-day concurrent firearms season, 2) no second opening day effect when antlerless deer season opened, and 3) reduced hunter participation in WMU 2G. We found no evidence to justify continuation of the 7-day concurrent firearms season to improve hunter activity or opinions towards deer hunting and management.

### **OBJECTIVES**

1. Estimate deer population abundance.
2. Determine relationship between deer population estimates, antlered harvest and antlerless hunter success rate indices.
3. Determine changes in antlerless hunter success rates from a 12-day concurrent to a 7-day concurrent firearm season.
4. Understand deer hunter experiences, satisfaction, and activity and the relationship from a 2-week concurrent to a 7-day concurrent firearms season.
5. Estimate changes in age structure of antlered harvest.
6. Determine whether deer population objectives can be achieved with a 7-day concurrent firearms season.

### **INTRODUCTION**

The Pennsylvania Game Commission (PGC) made several changes to deer hunting season structure since 2000. One of the most significant was the approval of a 12-day concurrent antlered and antlerless firearms season (hereafter, 12-day concurrent season) in 2001. Prior to 2001, firearms seasons for antlered and antlerless seasons were separate, with a 3-day antlerless-only firearms season immediately following the 12-day antlered-only deer season.

Although antlerless harvests can be manipulated effectively by modifying the antlerless allocation regardless of season length (PGC unpublished data), discussions to replace the 12-day concurrent season with another season format occurred inside and outside the Game Commission. One proposal was to have a 5-day antlered-only season, followed by a 7-day concurrent antlered and antlerless firearms season (hereafter, 7-day concurrent season).

The effect of changing from the 12-day concurrent season to a 7-day concurrent season on management measures, such as antlered harvest rates and antlerless hunter success and hunter satisfaction was unknown. This report describes research activities to measure the impact of a 7-day concurrent season on the biological (i.e., harvest rates, achievement of management objectives, etc) and social (hunter observations, activities, and attitudes) aspects of this regulation change.

## **METHODS**

### **Deer Capture, Survival, and Mortality Causes**

We captured deer from January to April in 2009, 2010, and 2011. We monitored survival of radio-marked deer through December 2012. Frequency of monitoring was a minimum of one time per week.

Mortality causes were determined by gross examination of the carcass or a necropsy by the PGC veterinarian. If a tagged deer was legally harvested, hunters were interviewed by biologist aides immediately after being notified to determine the time and circumstances of death.

### **Integrated Population Model Estimates**

Integrated population models (IPMs) offer a trade-off between what is logistically feasible to measure and making predictions necessary for wildlife management. IPMs are useful when only a subset of the population can be monitored. In Pennsylvania, count information is only obtained for the harvested portion of the population. Using estimates of fecundity, survival, and mortality, the relationship between the harvested portion of the population and the full population can be incorporated into a population model to estimate abundance. In addition, as long as there are more field-based estimates than there are model estimates, models can be developed that can estimate parameters for which there are no corresponding field estimates, such as fawn survival and harvest rates. A detailed description of the IPM is under development as part of a Master of Science program at Penn State University.

### **Antlerless Harvest Success Rates and Effectiveness of 7-Day Season**

We compared 4 experimental Wildlife Management Units (WMUs) (WMUs 2D, 2G, 3C, and 4B) and 4 control WMUs (WMUs 1A, 2F, 3A, and 4A) to determine the effect of the 7-day

concurrent season. We compared antlerless catch-per-unit-effort (CPUE) defined as antlerless harvest divided by number of antlerless licenses sold. The analysis is based on CPUEs before the season change (2004-2007) and after the season change (2008-2011).

For the first 2 years of the study, 2008-09 and 2009-10 hunting seasons, antlerless allocations remained unchanged in each experimental and control WMU. Following the 2009-10 hunting season, we assessed whether deer populations trends are meeting our objective of population stabilization. In April 2010, the Board of Commissioners decided to lower antlerless allocations. In 2011, more changes were made to allocations, season lengths, and antler point restrictions, further eroding the ability of this study to directly address some study objectives.

### **Hunter Satisfaction and Hunting Experiences**

We used hunter surveys to assess changes in hunter activities, opinions, and satisfaction with the modified antlerless season. In 2008, 2010, and 2012, we sent similar surveys (Appendix 1) to hunters in the experimental WMUs. In this way, we standardized any recall bias across surveys.

We used hunter diaries (Appendix 2) to determine changes in deer sightings and hunter activity, opinions, and satisfaction. Given the potential for recall bias on hunter surveys more than 2 months after the firearms season, we used hunter diaries to monitor daily deer sightings. The diaries were mailed to a sample of hunters prior to the start of firearms seasons. Diaries were mailed to hunters from study WMUs based on Game Take Survey results and a random sample of 1,000 non-respondents to the Game Take Survey from the preceding year. In addition to providing greater detail on daily hunting activities, hunter diaries allow us to compare diary and survey results to quantitatively evaluate the extent of recall bias. Hunter diary analyses are part of an ongoing graduate project, and will be available at a later date.

### **Antlered Harvest Age Structure**

Although we cannot make “before and after” comparisons using marked deer because of small sample sizes prior to the change to a 7-day concurrent season, it may be possible to observe changes in antlered harvest rates using age structure of the harvest from our sex-age-kill data collected during the firearms deer season. For example, if antlered harvest rates increase, we would expect to see a younger age structure in the harvest.

### **Hunter Numbers**

We used results from the annual Game Take Survey to estimate the number of hunter days during the firearms seasons in each study WMU (LiBrandi-Mumma 2006, LiBrandi-Mumma and Boyd 2007, Boyd and Cegelski 2008, Boyd and Weaver 2009; Boyd and Weaver 2010, Boyd and Weaver 2011, Johnson 2012). The Game Take Survey solicits responses from a sample of approximately 18,000 to 20,000 licensed hunters each year. We used standard responses to the Game Take Survey to estimate the number of days spent deer hunting during the firearms season in each study WMU.

## **RESULTS**

### **Deer Capture, Survival, and Mortality Causes**

Capture operations for this study occurred in each experimental WMU during 2009, 2010, and 2011. We captured 1,908 individual deer (Table 1). No capture operations took place in 2012. We marked 1,895 white-tailed deer with reward ear tags or radio collars during this study (Table 2). From January 2009 to June 2012, 281 radio collared deer were lost to mortality (Table 3). Legal harvest accounted for 70% of mortalities (Table 3). Over 400 reward tagged deer were reported as harvested following the 2009, 2010, and 2011 hunting seasons (Table 4).

Table 1. White-tailed deer captures by sex and age class from 2009 to 2011 in Wildlife Management Units 2D, 2G, 3C, and 4B, Pennsylvania. An adult is classified as an animal 1.0 years old or older.

<b>Sex/Age Class</b>	<b>Captures</b>
Male Adults	264
Male Fawns	538
Female Adults	680
Female Fawns	426
Total	1,908

Table 2. Number of deer marked with reward ear tags and radio collars from 2009 to 2011 in Wildlife Management Units 2D, 2G, 3C, and 4B, Pennsylvania. An adult was classified as an animal 1.0 years old or older.

<b>Sex/Age Class</b>	<b>Reward Tags</b>	<b>Radio Collars</b>
Male Adults	187	75
Male Fawns	382	151
Female Adults	600	77
Female Fawns	331	92
Total	1,500	395

Table 3. Mortality causes for radio collared white-tailed deer in Wildlife Management Units 2D, 2G, 3C, and 4B, Pennsylvania, May 2009–January 2012. An adult was classified as an animal 1.0 years old or older. These results include animals radio-collared in WMUs 2G and 4B prior to 2009.

Mortality cause	Total
<b>Legal harvest</b>	<b>196</b>
Male adults	125
Male fawns	<sup>a</sup>
Females	71
<b>Unrecovered harvest</b>	<b>17</b>
Male adults	7
Male fawns	<sup>a</sup>
Females	10
<b>Poaching</b>	<b>9</b>
Male adults	8
Male fawns	<sup>a</sup>
Females	1
<b>Roadkill</b>	<b>27</b>
Male adults	11
Male fawns	0
Females	17
<b>Natural Causes</b>	<b>0</b>
Male adults	2
Male fawns	0
Females	1
<b>Unknown/Other</b>	<b>28</b>
Male adults	11
Male fawns	4
Females	13
<b>Total</b>	<b>281</b>
Male adults	164
Male fawns	4
Females	113

<sup>a</sup> All marked deer are adults during the hunting seasons.

Table 4. Reported harvests of reward tagged white-tailed deer during the 2009, 2010, and 2011 hunting seasons in Pennsylvania.

Legal harvest	Total
Total	440
Male adults	232
Female adults	208

### Integrated Population Model Estimates

Point estimates of deer populations were estimated using an integrated population model. Prior to the change in season from 12-days to 7-days concurrent seasons, post-hunt populations

(i.e., late January) were relatively stable in the experimental WMUs (Fig. 1). Following the change in season length, post-hunt populations significantly increased (Fig. 1).

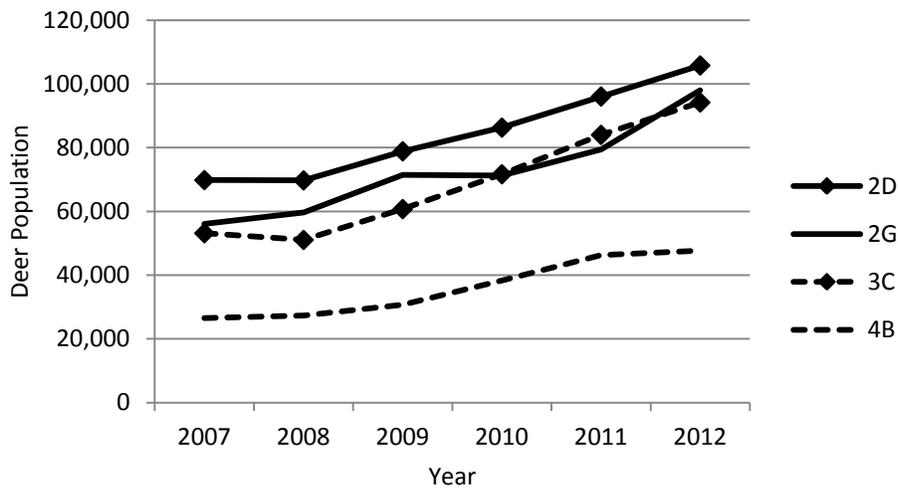


Figure 1. Post-hunt (i.e., late January) deer population estimates for Wildlife Management Units 2D, 2G, 3C, and 4B, Pennsylvania 2007 to 2012.

#### **Antlerless Harvest Success Rates and Effectiveness of 7-Day Concurrent Season**

In the 4 years prior to the change to a 7-day season in the 4 experimental WMUs, average CPUE in control and experimental WMUs were similar. Following the change to the 7-day season, CPUEs declined in the experimental WMUs and then increased as populations increased (Fig. 2). Changes including reductions in experimental WMUs' antlerless allocations and season length (WMU 2F reduced to 7-day concurrent season in 2011-12) prevent us from determining whether management objectives can be achieved with a 7-day concurrent season.

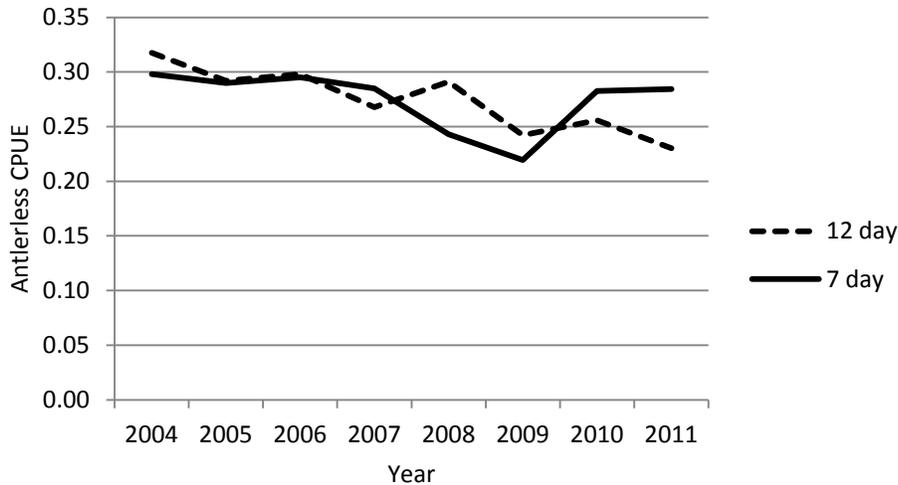


Figure 2. Average antlerless catch-per-unit-efforts for control Wildlife Management Units (12-day season) and experimental Wildlife Management Units (7-day season). The change to a 7-day season occurred in 2008. Pennsylvania 2004 to 2011.

### Hunter Satisfaction

We sent a total of 11,449 surveys to hunters in the experimental WMUs in 2008, 2010, and 2012. The 2008 survey represented hunter activities, opinions, and satisfaction following a 12-day concurrent season and prior to the change to a 7-day concurrent season. The 2010 and 2012 surveys represented hunter activities, opinions, and satisfaction following 2 years and 4 years of a 7-day concurrent season, respectively. Response rates ranged from 67 to 76 percent (Table 5). The following results compare hunter activities, opinions, and satisfactions before (2008 survey) and after (2012 survey) the change from a 12-day to 7-day concurrent season. Attempting to improve the experience of hunters during the firearms season was the justification for reducing the concurrent season. Consequently, results apply to hunters who pursued deer during the firearms season.

Table 5. Number mailed, undeliverable, returned, and response rates for surveys mailed to hunters in Wildlife Management Units 2D, 2G, 3C, and 4B, Pennsylvania 2008, 2010, and 2012.

Year	Mailed	Undeliverable	Returned	Response Rate
2008	3,181	59	2,374	76%
2010	3,521	138	2,293	68%
2012	4,747	51	3,168	67%

Firearms hunters saw more deer following the change in concurrent season length. In WMU 3C, hunters saw significantly more antlered deer. In WMUs 2G and 3C, hunters saw significantly more antlerless deer (Table 6). In every WMU, point estimates of antlered and antlerless deer seen increased, but not to biologically and/or statistically significant levels. Despite seeing more deer, the number of antlered and antlerless deer harvested by hunters remained the same (Table 7).

Table 6. Average number of antlered and antlerless deer seen by firearms hunters in Wildlife Management Units 2D, 2G, 3C, and 4B before and after reducing the concurrent firearms season from 12 days to 7 days and whether the results were statistically significant ( $\alpha = 0.05$ ), Pennsylvania, 2008 to 2012.

WMU	Antlered deer seen			Antlerless deer seen		
	Before	After	Significant?	Before	After	Significant?
2D	2.2	2.7	No	12.8	19.2	No
2G	1.4	1.9	No	6.2	8.6	Yes
3C	1.9	2.7	Yes	9.0	11.9	Yes
4B	1.4	1.4	No	5.9	7.6	No

Table 7. Antlered and antlerless harvest success rates (deer harvested per hunter) of firearms hunters in Wildlife Management Units 2D, 2G, 3C, and 4B before and after reducing the concurrent firearms season from 12 days to 7 days and whether the results were statistically significant ( $\alpha = 0.05$ ), Pennsylvania, 2008 to 2012.

WMU	Antlered deer harvested			Antlerless deer harvested		
	Before	After	Significant?	Before	After	Significant?
2D	0.15	0.09	No	0.28	0.19	No
2G	0.09	0.10	No	0.08	0.06	No
3C	0.15	0.17	No	0.23	0.16	No
4B	0.11	0.18	No	0.08	0.13	No

Antlered harvest success and antlerless CPUE were related to population density across 4 experimental WMUs. Antlered harvest success rates were significantly correlated to population density (Pearson's Correlation Coefficient = 0.8926,  $P = 0.0068$ ) when the low value for WMU 2D during the 2011 season was removed (Fig. 3). Antlerless CPUE was significantly correlated to the population density (Pearson's Correlation Coefficient = 0.8506,  $P = <0.0001$ , Fig. 4).

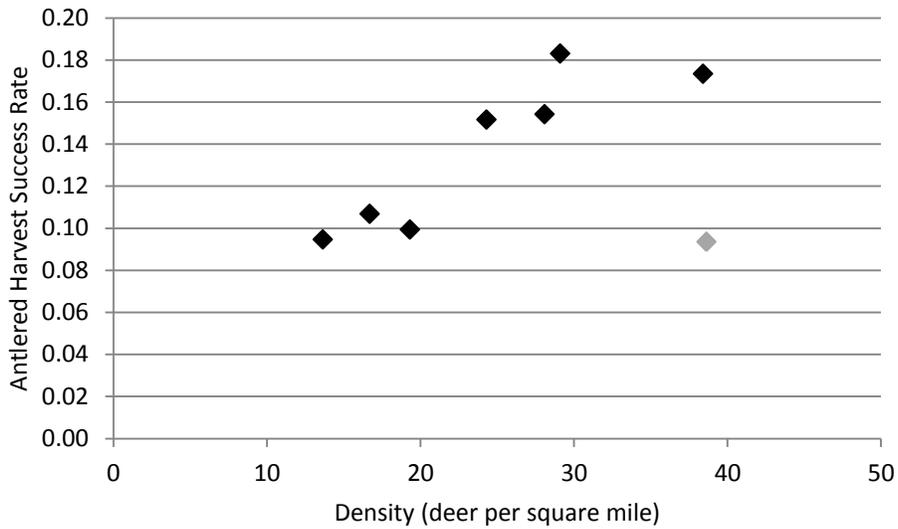


Figure 3. Relationship between deer density and antlered harvest success rates in Wildlife Management Units 2D, 2G, 3C, and 4B after reducing the concurrent firearms season from 12 days to 7 days, Pennsylvania 2008 to 2012. Note the outlier (gray point) from Wildlife Management Unit 2D in 2011.

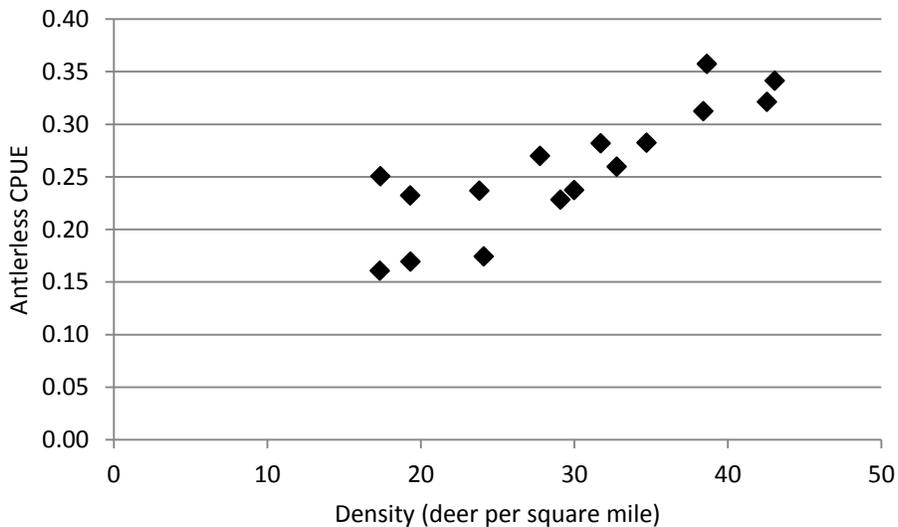


Figure 4. Relationship between deer density and antlerless catch-per-unit-effort in Wildlife Management Units 2D, 2G, 3C, and 4B after reducing the concurrent firearms season from 12 days to 7 days, Pennsylvania 2008 to 2012.

Firearms hunters hunted the same or fewer days following the change in season length. Hunters typically hunted 4 to 5 days during the 12-day firearms season before and after the

change in concurrent season length (Table 8). In all WMUs, except WMU 2G, hunter participation remained the same on the opening day, second day, and the 2 Saturdays during the firearms season. In WMU 2G, hunter participation declined on the opening day and second day, and remained at the same low levels during the 2 Saturdays (Table 9). In addition, a lower percentage of hunters traveled to hunt in WMU 2G (e.g., 82 percent before, 68 percent after).

Table 8. Average number of days hunted by firearms hunters in Wildlife Management Units 2D, 2G, 3C, and 4B before and after reducing the concurrent firearms season from 12 days to 7 days and whether the results were statistically significant ( $\alpha = 0.05$ ), Pennsylvania 2008 to 2012.

WMU	Before	After	Significant?
2D	4.9	5.0	No
2G	4.6	4.5	No
3C	5.1	4.7	No
4B	5.2	4.3	Yes

Table 9. Percent of hunters hunting on the opening day, second day, and Saturdays of the firearms season in Wildlife Management Units 2D, 2G, 3C, and 4B before and after reducing the concurrent firearms season from 12 days to 7 days. Following the change from a 12-day to 7-day concurrent season, the first Saturday became the opening day for antlerless hunting, Pennsylvania 2008 to 2012.

WMU	Opening Day		2 <sup>nd</sup> Day		1 <sup>st</sup> Saturday		2 <sup>nd</sup> Saturday	
	Before	After	Before	After	Before	After	Before	After
2D	0.93	0.93	0.62	0.56	0.77	0.75	0.62	0.64
2G	0.92	0.82 <sup>a</sup>	0.83	0.68 <sup>a</sup>	0.42	0.46	0.31	0.35
3C	0.92	0.93	0.79	0.70	0.61	0.66	0.52	0.54
4B	0.92	0.85	0.76	0.67	0.75	0.68	0.60	0.51

<sup>a</sup> Statistically significant decline

Firearms hunters' attitude towards the deer population did not change following the change in concurrent season length. A minority of hunters indicated the deer population was 'about right' both before and after the change in concurrent season length (Fig. 5).

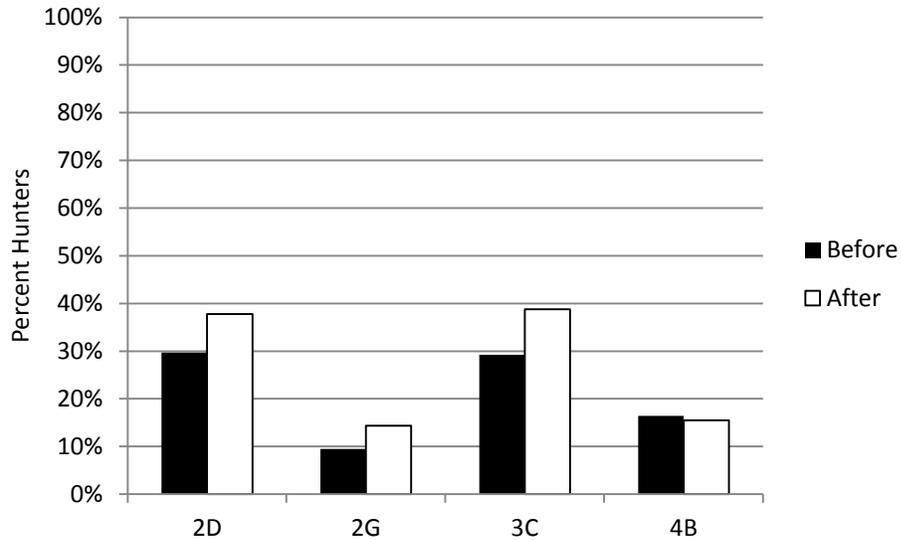


Figure 5. Percent of firearms hunters who considered the deer population to be 'just right' in Wildlife Management Units 2D, 2G, 3C, and 4B before and after reducing the concurrent firearms season from 12 days to 7 days, Pennsylvania 2008 to 2012.

Satisfaction with their hunting experience increased for firearms hunters in WMUs 2G and 4B, but remained low. For firearm hunters in WMUs 2D and 3C, satisfaction with their hunting experience did not change (Fig. 6). In all WMUs, a minority of firearms hunters were satisfied with their hunting experience.

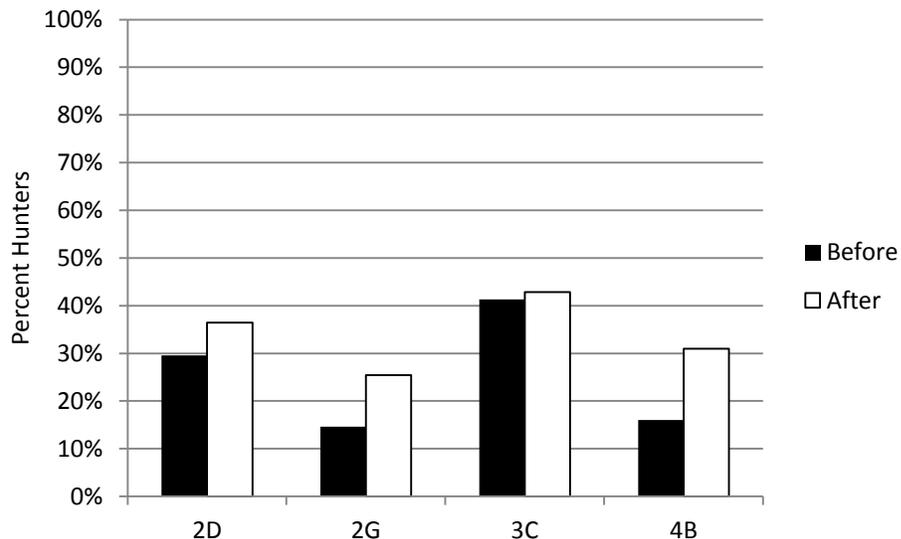


Figure 6. Percent of firearms hunters who were satisfied with their hunting experience in Wildlife Management Units 2D, 2G, 3C, and 4B before and after reducing the concurrent firearms season from 12 days to 7 days, Pennsylvania 2008 to 2012.

Firearms hunters' attitude towards the firearms season did not change following the change in the concurrent firearms season length. Most hunters continued to agree that the 12-day concurrent season allowed too many deer to be harvested (Fig. 7) and a minority rated the firearm season regulations as good or excellent (Fig. 8). Although support for the 7 day concurrent firearms season increased from 15 percent before the change to 25 percent after the change, the firearms season option receiving the most support (48 percent) was returning to a 12-day antlered season followed by a 3-day antlerless season.

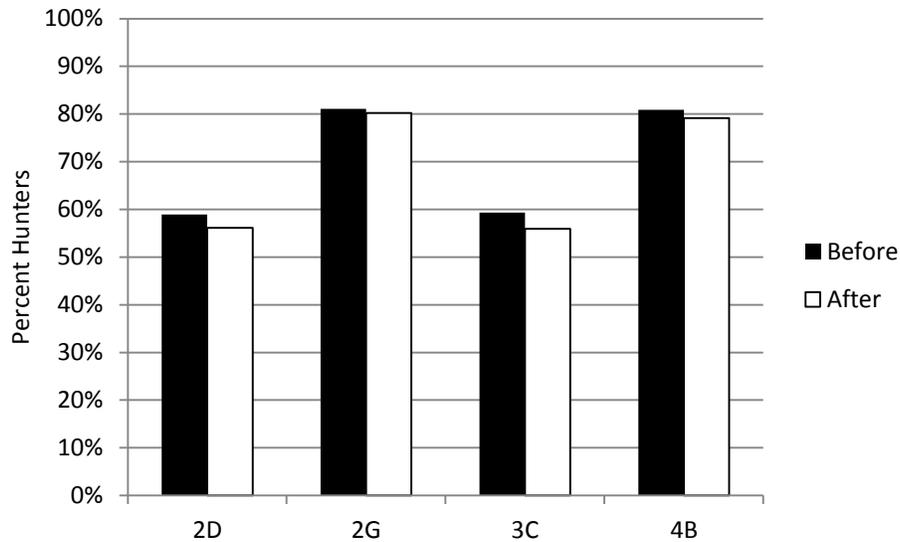


Figure 7. Percent of firearms hunters who agreed that too many deer were killed during the 12-day concurrent firearms season in Wildlife Management Units 2D, 2G, 3C, and 4B before and after reducing the concurrent firearms season from 12 days to 7 days, Pennsylvania 2008 to 2012.

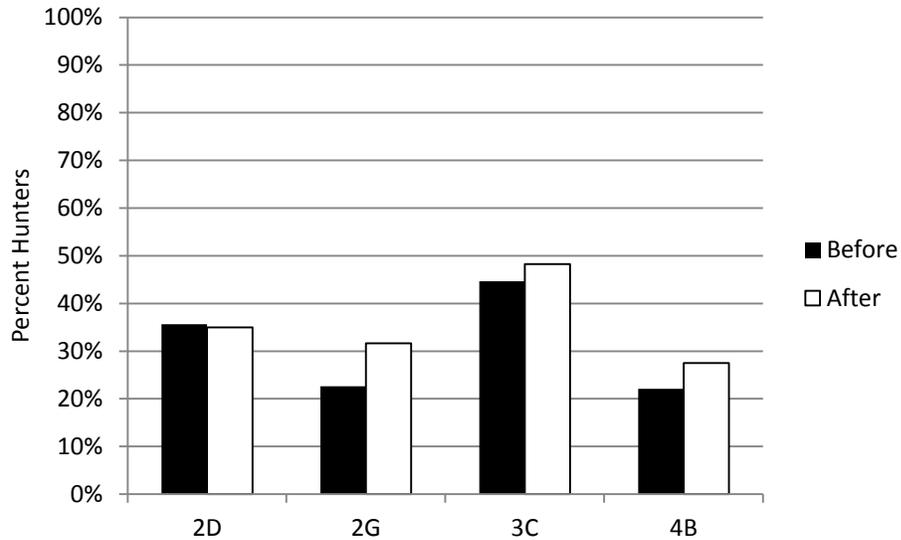


Figure 8. Percent of firearms hunters who rated the firearms season as good or excellent in Wildlife Management Units 2D, 2G, 3C, and 4B before and after reducing the concurrent firearms season from 12 days to 7 days, Pennsylvania 2008 to 2012.

Hunter opinions towards the deer management program did not change following the change in the concurrent firearms season length. A minority of firearms hunters rated the deer program as good or excellent before and after the change in concurrent firearms season length (Fig. 9).

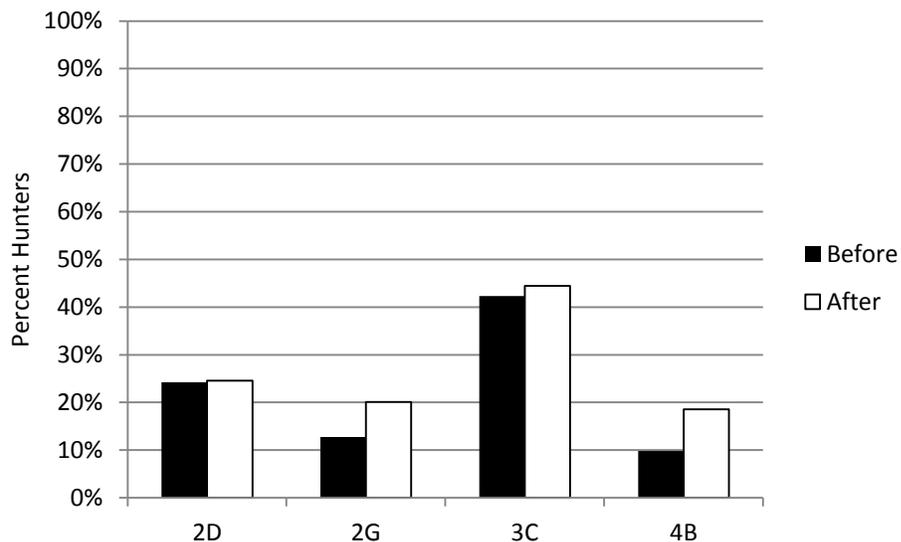


Figure 9. Percent of firearms hunters who rated the Game Commission's deer program as good or excellent in Wildlife Management Units 2D, 2G, 3C, and 4B before and after reducing the concurrent firearms season from 12 days to 7 days, Pennsylvania 2008 to 2012.

### Antlered Harvest Age Structure

Age structure of antlered harvest was similar before and after the change in concurrent firearms season length in both the experimental and control WMUs (Fig. 10). Within each WMU, the percent of yearling males (approximately 1.5 years-of-age) in the antlered harvest varied from 9 to 19 percent over the 8 years (2004 to 2011) of this study.

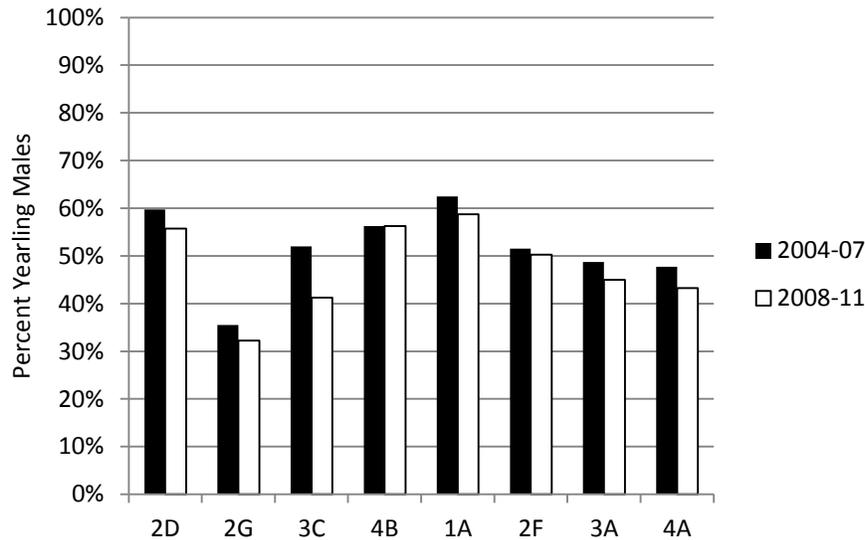


Figure 10. Average percent of yearling males in the antlered harvest before (2004-2007) and after (2008-2011) reducing the concurrent firearms season from 12 days to 7 days in the experimental Wildlife Management Units (2D, 2G, 3C, and 4B) and control Wildlife Management Units (1A, 2F, 3A, and 4A), Pennsylvania 2004 to 2011.

### Hunter Densities and Activity

Estimated hunter effort was similar before and after the change in concurrent firearms season length in both the experimental and control WMUs (Fig. 11).

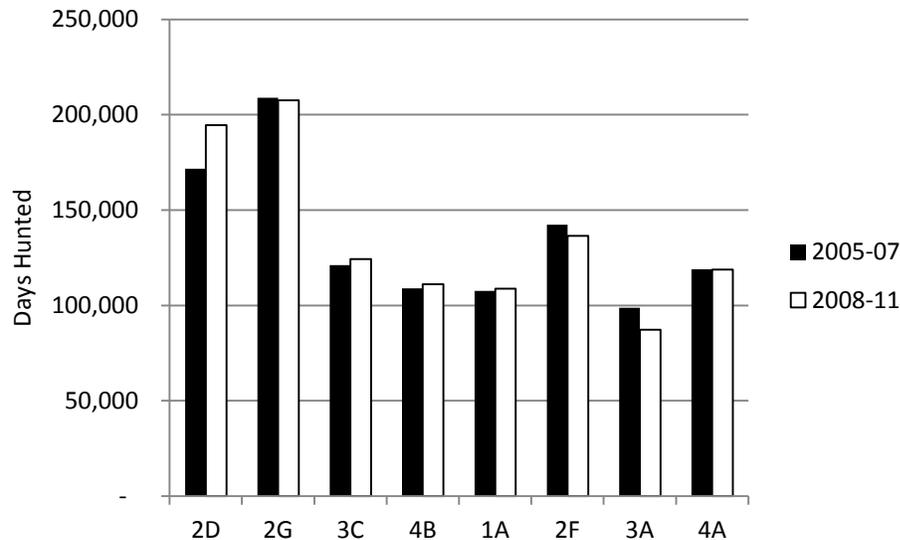


Figure 11. Estimated hunter effort (days hunted) during the firearms season before (2005-2007) and after (2008-2011) reducing the concurrent firearms season from 12 days to 7 days in the experimental Wildlife Management Units (2D, 2G, 3C, and 4B) and control Wildlife Management Units (1A, 2F, 3A, and 4A), Pennsylvania 2004 to 2011. Note the Game Take Survey was not conducted in 2004.

## DISCUSSION

### Deer population abundance

Deer populations in all experimental WMUs increased during this study and prevented achievement of all study objectives. Population increases confound any efforts to attribute changes in numbers of deer seen or harvested or hunter attitude changes to the change in season length. A shorter antlerless firearms season and a constant antlerless allocation caused hunter success rates to decline in the first 2 years of this experiment. Although the study plan called for adjustments to the antlerless allocation to achieve management objectives in the third year of the study, the Board of Game Commissioners approved antlerless license reductions in all experimental WMUs; thus compromising our ability to assess the management value of the 7-day concurrent season in these WMUs.

### Relationship between deer population estimates and indices

Indices of harvest (antlered success rates and antlerless CPUE) were generally correlated with deer population density. The antlered success rate was strongly correlated when the results from WMU 2D in 2011 were removed from the analysis. This result from WMU 2D indicated an antlered harvest success rate of 0.09 with a density of 39 deer per square mile in 2011 compared to an antlered harvest success rate of 0.15 with a density of 28 deer per square mile in 2007. This low value appears to be an outlier because hunter effort remained similar and hunters saw similar or slightly more antlered deer in 2011. As a result, we believe it was appropriate to remove this outlier from the analysis. Antlerless CPUE showed a strong correlation across the range of densities (17–43 deer per square mile) observed in this study.

### **Antlerless hunter success rates**

Antlerless hunter success rates initially declined with a shorter concurrent season. After 2 years, antlerless success rates were an average of 20 percent lower than in previous years. To maintain similar harvests with shorter seasons required increased antlerless allocations. However, in this study, antlerless allocations decreased and deer populations increased. As a result, antlerless hunter success rates increased to pre-season change levels.

### **Deer hunter experiences, satisfaction, and activity**

This study failed to achieve its intended benefit to improve hunter satisfaction. The purpose of reducing the 12-day concurrent season to a 7-day concurrent season was to increase sightings of antlerless deer, which was considered a key component of hunter satisfaction (January 2010 Minutes, page 27). Number of antlerless deer seen and satisfaction with hunting experience varied by WMU, but no WMUs showed improvement in satisfaction with deer abundance, firearms seasons, or the deer program (Table 10).

Table 10. Summary of hunter observations and attitudes 4 years after reducing the concurrent firearms season from 12 days to 7 days, Pennsylvania 2012.

<b>WMU</b>	<b>Saw more antlerless deer?</b>	<b>More satisfied with hunting experience?</b>	<b>More satisfied with deer abundance?</b>	<b>More satisfied with firearms season?</b>	<b>More satisfied with deer program?</b>
2D	No	No	No	No	No
2G	Yes	Yes	No	No	No
3C	Yes	No	No	No	No
4B	No	No	No	No	No

Despite substantial, consistent, and undesired deer population increases in the experimental WMUs, hunter sightings of antlerless deer and satisfaction showed inconsistent improvements and, when it did improve, it remained at low levels. For example, hunter satisfaction with their hunting experiences increased in WMUs 2G and 4B from 15 to 25 percent and 16 to 31 percent, respectively. However, even with these increases, less than a third of hunters were satisfied with their hunting experience. These results unequivocally confirm the failure of a 7-day concurrent season and increased deer populations to improve hunter satisfaction and opinions towards the deer management program.

The 7-day concurrent season did not improve hunter activity or effort. We observed no increase in hunter activity on the first Saturday (i.e., antlerless opening day). In all experimental WMUs, participation remained similar before and after the season change. However, in WMU 2G, hunter participation declined on the opening day and 2<sup>nd</sup> day. This decline resulted in 5,000 to 8,000 fewer hunters. Most of whom appear to have been hunters who lived outside the WMU. Before the season change 82 percent of WMU 2G hunters traveled to hunt WMU 2G. After the season change, only 68 percent of WMU 2G hunters traveled to hunt WMU 2G. As a result, it appears the 7-day concurrent firearms season reduced the hunters traveling to WMU 2G to hunt.

### **Age structure of antlered harvest**

The change from a 12-day concurrent season to a 7-day concurrent season had little effect on age structure of antlered harvests. In both the control and experimental WMUs, age structure of the antlered harvest remained the same or declined slightly. As a result, we conclude that the shorter concurrent firearms season had no effect on antlered harvest rates.

### **Management implications**

Due to deer populations increases, we could not determine whether deer population objectives could be achieved with a 7-day concurrent season. Considering the population increases and the fact that the 7-day concurrent season was more compatible with a majority of hunters' desires for shorter antlerless season, we expected increased hunter satisfaction when the 12-day concurrent season was reduced to a 7-day concurrent season. However, when all of the results are considered, we conclude that the 7-day concurrent season failed to achieve its stated objectives. Hunter satisfaction with deer populations, regulations, and the Game Commission's deer program did not improve.

Based on study results, we identified a number of negative consequences. First, shortening the season without increasing antlerless allocations thereby allowing deer populations to increase supports the false notion that too many deer are killed during a 12-day concurrent season. We found a majority of hunters in the experimental WMUs believed too many deer were killed during the 12-day concurrent season. Following this experiment, where the season was shortened and deer populations increased, negative views of the 12-day concurrent season may be reinforced. Although the population increases can be explained by looking at antlerless allocations, these details are often missed in public deer management debates. Second, there was no second opening day effect. More hunters did not hunt the first Saturday when antlerless season opened. As a result, hunters did not experience greater hunter and deer activity than they would have experienced under a regular 12-day concurrent firearms season. The harvest of antlerless deer is crucial to management, and the opening day for antlerless deer in WMUs with a 7-day concurrent season was ineffective from social and management perspectives. Third, in WMU 2G, where much of the dissatisfaction that prompted this study took place, fewer hunters hunted on the first and second days after they became antlered only. An important component to hunters seeing deer is for other hunters to be moving those deer. By establishing a season that reduced hunter participation during key hunting days, the 7-day concurrent season negated any potential 'deer sighting' benefit of 'saving antlerless deer for 5 more days'. Clearly, many of the hunters who travel to hunt in WMU 2G did not make the trip following the reduction from a 12-day to a 7day concurrent season.

Negative opinions and dissatisfaction towards a towards a 12-day concurrent season are unlikely to be affected by shortening the season. In 2001, prior to the establishment of the 12-day concurrent season, many Pennsylvania hunters who were opposed to the 12-day concurrent firearms season remained opposed when presented with shorter options (Responsive Management 2001). This was seen again in 2008 in the first survey conducted as part of this study, a majority of hunters in the experimental WMUs opposed concurrent seasons of any length and instead favored the 12-day antlered only season followed by the 3-day antlerless only season format. In 2012, these results remain unchanged. Clearly, preferences and opinions regarding concurrent firearms seasons are not affected by length of season or deer population abundance.

The 7-day concurrent firearms season can lead to more antlerless licenses for hunters, but this may not be the best option for increasing hunting opportunity. In the experimental WMUs, it took about 20 percent more tags to kill the same number of deer during the first 2 years. If the same harvest is desired, then the allocation must be increased when the concurrent firearms season is shortened. Increasing antlerless allocations is not without risk as hunters often focus on the number of licenses without regard to the objectives and factors affecting an antlerless license allocation. In a recent survey of Pennsylvania hunters, time to hunt, not opportunity to hunt antlerless deer, was the most important factor for hunters with increased hunting interest (PGC, unpublished data). A 12-day concurrent season provides the best option for allowing the most time for hunters to take a deer of their choice.

The 7-day concurrent firearms season was proposed as an option to address hunter discontent, but the reduced antlerless season failed to improve measurables regarding hunter satisfaction with the deer population or the deer program. Results of this study and recent surveys of hunters clearly demonstrate the benefits of a 12-day concurrent season to provide more days for hunters to hunt any deer and for the deer program to achieve its publicly-identified and supported management goals.

#### **LITERATURE CITED**

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**Appendix 1. 2012 Deer hunter survey to determine changes in hunter opinions, activities, and experiences. This was the third in a series of surveys conducted previously in 2008 and 2010. The survey instrument remained the same for all 3 surveys.**

**Pennsylvania Game Commission  
2012 Deer Hunter Survey**

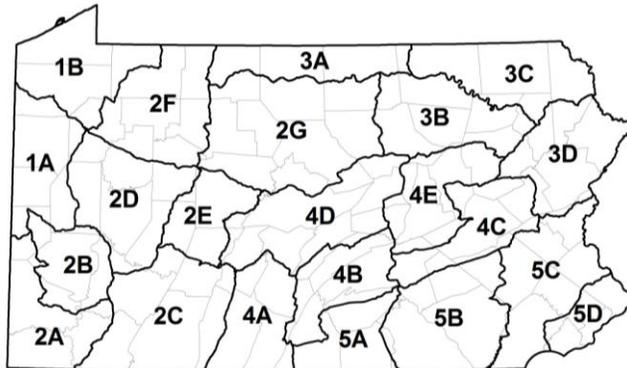
1) Which licenses and stamps did you purchase for the 2011-12 seasons? (Circle all that apply)

1. GENERAL HUNTING LICENSE
2. COMBINATION LICENSE FOR JUNIORS OR SENIOR LIFETIME RESIDENTS
3. ANTLERLESS LICENSES
4. DEER MANAGEMENT ASSISTANCE PROGRAM PERMITS (DMAP)
5. ARCHERY STAMP
6. MUZZLELOADER STAMP
7. I DID NOT PURCHASE A HUNTING LICENSE, go to **QUESTION 16**

2) Did you hunt deer during the 2011-12 hunting seasons in Pennsylvania? (Circle one number)

1. YES            If YES, go to **QUESTION 3**
2. NO             If NO, go to **QUESTION 16**

3) In which Wildlife Management Unit (WMU) did you hunt deer the most during the 2011-12 hunting seasons? (Circle the WMU label, for example "1A")



Questions 4 through 15 refer to your hunting activity and success during the 2011-12 hunting seasons in the WMU where you hunted deer the most.

4) Do you travel and stay overnight when hunting in the WMU where you hunted deer the most? (Circle one number)

1. YES
2. NO

5) How many antlerless licenses and/or DMAP permits did you buy for yourself in the WMU where you hunted deer the most?

6) How many antlered deer did you see in the WMU where you hunted deer the most? \_\_\_\_\_

7) How many legal\*, antlered deer did you see in the WMU where you hunted deer the most? \_\_\_\_\_

\* a legal antlered deer is any antlered deer that had enough points to be harvested under current antler restrictions

8) How many antlerless deer did you see in the WMU where you hunted deer the most? \_\_\_\_\_

9) Did you harvest an antlered deer in the WMU where you hunted deer the most? (Circle one number)

1. YES
2. NO

10) How many antlerless deer did you harvest in the WMU where you hunted deer the most? \_\_\_\_\_

11) In the WMU where you hunted deer the most, on what kind of land did you hunt? (Circle one number)

1. PRIVATELY-OWNED LAND (ex. owned by private citizens or businesses)
2. PUBLICLY-OWNED LAND (ex. owned by governments, such as game lands)
3. BOTH PRIVATELY-OWNED AND PUBLICLY-OWNED LAND

12) In the WMU where you hunted deer the most, how many days did you hunt for at least 1 hour during the following hunting seasons?

- |  |       |      |
|--|-------|------|
| 1. FALL ARCHERY                        | _____ | DAYS |
| 2. FALL MUZZLELOADER                   | _____ | DAYS |
| 3. ARCHERY AFTER THE CONCURRENT SEASON | _____ | DAYS |
| 4. FLINTLOCK AFTER CHRISTMAS           | _____ | DAYS |

13) In the WMU where you hunted deer the most, during which days of the concurrent firearms season did you hunt at least 1 hour? (Circle all that apply)

- |                                    |                                    |
|------------------------------------|------------------------------------|
| 1. MONDAY, 1 <sup>ST</sup> WEEK    | 7. MONDAY, 2 <sup>ND</sup> WEEK    |
| 2. TUESDAY, 1 <sup>ST</sup> WEEK   | 8. TUESDAY, 2 <sup>ND</sup> WEEK   |
| 3. WEDNESDAY, 1 <sup>ST</sup> WEEK | 9. WEDNESDAY, 2 <sup>ND</sup> WEEK |
| 4. THURSDAY, 1 <sup>ST</sup> WEEK  | 10. THURSDAY, 2 <sup>ND</sup> WEEK |
| 5. FRIDAY, 1 <sup>ST</sup> WEEK    | 11. FRIDAY, 2 <sup>ND</sup> WEEK   |
| 6. SATURDAY, 1 <sup>ST</sup> WEEK  | 12. SATURDAY, 2 <sup>ND</sup> WEEK |

14) In the WMU where you hunted deer the most, were you satisfied with your deer hunting experience? (Circle one number)

1. VERY SATISFIED
2. SOMEWHAT SATISFIED
3. NEITHER SATISFIED NOR DISSATISFIED
4. SOMEWHAT DISSATISFIED
5. VERY DISSATISFIED

15) In the WMU where you hunted deer the most, do you feel the deer population is (Circle one number)

1. TOO HIGH
2. ABOUT RIGHT
3. TOO LOW

Please circle the number that most closely describes your agreement with the following statements.

	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
<b>16)</b> The regular firearms season should be concurrent for antlered and antlerless deer for 2 weeks.	1	2	3	4	5
<b>17)</b> The regular firearms season should be 1 week antlered only with 1 week concurrent for antlered and antlerless deer.	1	2	3	4	5
<b>18)</b> The regular firearms season should be 2 weeks antlered only followed by 3 days of antlerless deer only.	1	2	3	4	5
<b>19)</b> Too many antlerless deer are harvested during a 2-week concurrent season.	1	2	3	4	5
<b>20)</b> A shorter concurrent season will allow deer populations to increase.	1	2	3	4	5
<b>21)</b> I support current antler restrictions in the WMU where I hunted deer the most.	1	2	3	4	5

**22)** If deer numbers stayed the same, of the 3 choices listed below, I would prefer a firearms deer season that is: (Circle one number)

1. A 2-WEEK CONCURRENT ANTLERED AND ANTLERLESS SEASON
2. A 6-DAY ANTLERED ONLY SEASON FOLLOWED BY A 6-DAY CONCURRENT SEASON STARTING ON A MONDAY
3. A 5-DAY ANTLERED ONLY SEASON FOLLOWED BY A 7-DAY CONCURRENT SEASON STARTING ON A SATURDAY

Please indicate your satisfaction by ranking the Game Commission's performance in the following areas. Circle the number that corresponds to your response.

	Don't Know	Poor	Fair	Good	Excellent
<b>23)</b> Firearm deer seasons	1	2	3	4	5
<b>24)</b> Overall deer management	1	2	3	4	5

**25)** My primary reason for rating the deer program as I did is: (Circle one number)

1. ANTLER RESTRICTIONS
2. ANTLERLESS ALLOCATIONS
3. LENGTH OF HUNTING SEASONS
4. NUMBER OF DEER SEEN OR HARVESTED
5. OTHER (PLEASE EXPLAIN):

**INSTRUCTIONS FOR RETURNING SURVEY:**

Thank you for your interest in deer management in Pennsylvania, and taking the time to complete this survey. Please return your questionnaire in the self-addressed, postage paid envelope provided. Be assured your answers will remain confidential.

**Appendix 2. 2011-12 Deer hunter diary to determine changes in deer sightings and hunter activity, opinions, and satisfaction.**



Pennsylvania Game Commission  
Deer Hunter Diary – 2011 Firearms Season (November 28<sup>th</sup> to December 10<sup>th</sup>)



**1. Which of the following licenses and stamps did you purchase for the 2011-12 hunting seasons? (Circle all that apply)**

1. GENERAL HUNTING LICENSE
2. JUNIOR or SENIOR COMBINATION HUNTING LICENSE
3. LANDOWNER LICENSE
4. ARCHERY STAMP
5. MUZZLELOADER STAMP

**2. How many WMU-specific antlerless licenses did you purchase? \_\_\_\_\_**

**3. How many DMAP permits did you purchase? \_\_\_\_\_**

**4. How many days did you scout for deer prior to the rifle season? (Circle one number)**

1. 0 DAYS
2. 1-5 DAYS
3. 6-10 DAYS
4. MORE THAN 10 DAYS

**5. Did you hunt during any of the early deer seasons (i.e., Archery, October muzzleloader, and October rifle)? (Circle all that apply)**

1. YES, ARCHERY SEASON
2. YES, OCTOBER MUZZLELOADER SEASON
3. YES, OCTOBER RIFLE SEASON FOR JUNIOR, SENIOR, DISABLED PERSON PERMIT HOLDER, & ACTIVE MILITARY
4. NO, I DID NOT HUNT DEER DURING ANY EARLY SEASONS

**5A. If you hunted during one of the early seasons, did you harvest any deer during these early seasons?**

1. NO
2. YES, AN ANTLERED DEER
3. YES, \_\_\_\_\_ ANTLERLESS DEER

**INSTRUCTIONS FOR COMPLETING HUNTER DIARY (on back):**

Each time you hunt deer during the rifle season (November 28 to December 10, 2011) please complete a row on the following sheet. You may have more than one entry for a day if you went out for two separate hunts.

- For land ownership, please record whether the land was privately owned, State Game Lands (SGL) or other publicly owned. For example, other publicly owned lands include State Forest Lands, State Parks, and National Forest. If you hunted on multiple land ownerships on a hunt, for example private lands and state game lands, circle both "Private" and "SGL".
- When hunting, if you cannot identify a deer as antlered or antlerless, please record as "Unk" for unknown.

**INSTRUCTIONS FOR RETURNING HUNTER DIARY:**

Please return your diary in the self-addressed, postage paid envelope provided by **December 16, 2011**.  
Your answers will remain confidential.

## Pennsylvania Deer Hunter Diary – 2011 Firearms Season (November 28 to December 10, 2011)

	Date	WMU	Ownership of land hunted (circle all that apply)	Hours Hunted (to the nearest ½ hour)	Antlered deer seen while hunting	Antlerless deer seen while hunting	Unk deer seen	Did you harvest an antlered deer?		If you harvested an antlered deer, how many points did it have?	How many ANTLERLESS deer did you harvest with a WMU antlerless license?	How many ANTLERLESS deer did you harvest with a DMAP permit?	Did you hunt as part of a deer drive?	
								YES	NO				YES	NO
	11/29	3B	Private SGL Other Public	4.5	1	2	1	YES	NO	0	1	0	YES	NO
1			Private SGL Other Public					YES	NO				YES	NO
2			Private SGL Other Public					YES	NO				YES	NO
3			Private SGL Other Public					YES	NO				YES	NO
4			Private SGL Other Public					YES	NO				YES	NO
5			Private SGL Other Public					YES	NO				YES	NO
6			Private SGL Other Public					YES	NO				YES	NO
7			Private SGL Other Public					YES	NO				YES	NO
8			Private SGL Other Public					YES	NO				YES	NO
9			Private SGL Other Public					YES	NO				YES	NO
10			Private SGL Other Public					YES	NO				YES	NO
11			Private SGL Other Public					YES	NO				YES	NO
12			Private SGL Other Public					YES	NO				YES	NO

*IF MORE SPACE IS NEEDED, PLEASE COMPLETE THE SAME INFORMATION AND ATTACH ADDITIONAL SHEET(S) TO THIS FORM*

Please complete questions 6 and 7 after the 2011 rifle season

**6. How do you rate your satisfaction with your hunting experience during the 2011 rifle season? (Circle one number)**

1. VERY DISSATISFIED    2. DISSATISFIED    3. NEITHER SATISFIED NOR DISSATISFIED    4. SATISFIED    5. VERY SATISFIED

**7. How do you rate the Pennsylvania Game Commission's deer management program? (Circle one number)**

1. DON'T KNOW    2. POOR    3. FAIR    4. GOOD    5. EXCELLENT