

**PENNSYLVANIA GAME COMMISSION
BUREAU OF WILDLIFE MANAGEMENT
PROJECT ANNUAL JOB REPORT**

PROJECT CODE NO.: 06210

TITLE: White-tailed Deer Research/Management

JOB CODE NO.: 21015

TITLE: Biological and social implications of a 7-day concurrent firearms season

PERIOD COVERED: 1 July 2008 through 30 June 2009

COOPERATING AGENCIES: Pennsylvania Cooperative Fish and Wildlife Research Unit, Pennsylvania State University

WORK LOCATION(S): Private and public lands in Wildlife Management Units 2D, 2G, 3C, and 4B

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ABSTRACT In 2008, the Board of 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 management implications that could occur due to this change to the firearms season. From January-April 2009, we captured 733 deer, marking 470 with \$100 reward ear tags and 157 with radio collars. From July 2008-April 2009, 88 deer died, with the main cause of death being legal harvest. Antlerless season catch-per-unit-effort and harvests declined from 2007-08 to 2008-09 in 3 of 4 experimental units, while remaining relatively stable in all 4 control units (WMUs 1A, 2F, 3A, and 4A). The proportion of yearling bucks in the harvest decreased slightly in most control and treatment WMUs. To monitor social implications, 2,356 deer hunter diaries were mailed to hunters in experimental and control WMUs with a 54% response rate.

OBJECTIVES

1. Estimate deer population abundance on each study area.
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.

METHODS

Deer Capture, Survival, and Mortality Causes

Fieldwork to capture and monitor white-tailed deer (*Odocoileus virginianus*) was conducted in Wildlife Management Units (WMUs) 2D, 2G, 3C, and 4B. Field activities occurred across a broad area within each WMU to increase variability of survival and harvest covariates, thus improving biological inference of the relationship between survival and harvests and covariates (Steury et al. 2002).

We used drop nets (Conner et al. 1987), rocket nets, and modified Clover traps (Clover 1954, McCullough 1975) baited with corn to capture deer. Deer captured using drop-nets and rocket nets were sedated with a light, intramuscular (IM) dose of xylazine hydrochloride (XYL), and face-masked. XYL was delivered via hand syringe at about 0.6 mg/kg body weight, or about 20 mg for a fawn, 30 mg for a yearling, and 40 mg for an adult. These dosages were well below the dosage recommended by Bubenik (1982) for immobilization of white-tailed deer using xylazine alone; complete sedation was not required to facilitate handling deer tangled in the nets. Deer captured with Clover traps were manually restrained and face-masked.

When captured, all deer were fitted with an ear tag in each ear. A goal of 60 collared deer (15 yearling bucks, 15 adult bucks, and 30 does) was set for WMUs 2D, 2G, and 3C. Collars were standard VHF radiocollars that use microchip technology to indicate time of mortality. A reduced goal of radiocollaring 9 yearling bucks, 6 adult bucks, and 15 does on 4B was established because this area already had deer marked from the previous study (Rosenberry et al. 2008). An additional 180 deer (60 yearling bucks, 60 adult bucks, and 60 does) were to be marked in each study area with bicolored ear tags (white on the inside of the ear and black on the outside) to reduce visibility of tags to hunters while hunting. The tag was labeled with a random ID number, toll-free phone number, and \$100 reward for reporting the tagged animal. Rewards would be paid by the Pennsylvania Cooperative Fish and Wildlife Research Unit (PCFWRU) through a grant agreement with the Pennsylvania Game Commission (PGC). Handling protocols for deer were approved by the Pennsylvania State University (PSU) Institutional Animal Care and Use Committee.

Deer manually restrained by personnel were immediately released after individual markers were applied. Chemical immobilizations were antagonized with IM injections of tolazoline

hydrochloride (TOL; 4.0 mg/kg) because it provides a more consistent antagonism of xylazine than yohimbine hydrochloride (Kreeger 1996).

We monitored survival using radio telemetry. Frequency of monitoring was a minimum of one time per month during the winter trapping season, and at least one time per week during the remainder of the year.

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.

Unbiased Population Estimates

Changing the firearms season format can potentially bias current methods of monitoring deer population abundance and trends. Some methods may be biased high, and others may be biased low. This creates confusion from which accurate assessment of changes in deer population abundance would not be possible. Unbiased population estimates and trends will be required to evaluate and explain observed changes in hunter success, behavior, and satisfaction.

In addition, combining deer population estimates with population indices provides an opportunity to investigate index calibration. Calibrating population indices with actual population estimates would strengthen the basis for future deer population monitoring and management recommendations.

Antlerless Harvest Success Rates and Effectiveness of 7-Day Season

We used a repeated-measures ANOVA with 4 experimental WMUs (WMUs 2D, 2G, 3C, and 4B) and 4 control WMUs (WMUs 1A, 2F, 3A, and 4A). Analysis 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 are to remain unchanged in each treatment and control WMU. Following the 2009-10 hunting season, we will assess whether deer populations trends are meeting our objective of population stabilization. Adjustments to antlerless allocations for the 2010-11 and 2011-12 hunting seasons may be recommended if needed.

Hunter Satisfaction

We used hunter surveys to assess changes in hunter satisfaction with the modified antlerless season. A pre-treatment hunter survey was conducted in February 2008. Surveys were sent to hunters who hunted in each of the experimental WMUs during the 2005-06 and 2006-07 hunting seasons based on Game Take Survey results. Future surveys will be conducted following the 2009 and 2011 seasons. Surveys are conducted every other year to increase sample sizes so we may assess differences in hunter activity, opinions, and satisfaction between surveys. Because the 2008 surveys were mailed in mid-February, we will continue to send surveys to hunters from each WMU in February of 2010, and 2012. In this way, we can standardize any recall bias across surveys.

Surveys asked hunters to rate their level of satisfaction with the firearms deer season and overall deer management. In addition to these ratings, we asked hunters to indicate their primary reason for rating the deer program as they did. Changes in responses to these questions are the basis for evaluating changes in hunter satisfaction.

Additional cross-tabs and information that may explain changes in hunter satisfaction included questions on deer seen, deer harvested, and population estimates.

Deer Hunting Experiences

We used hunter diaries (Appendix 1) 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 also used hunter diaries to monitor deer sightings. The diaries were mailed to a sample of hunters prior to the start of firearms seasons in 2008 and will be mailed in 2009, 2010, and 2011 as well. Surveys were mailed to hunters from experimental and control 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 results to survey results to quantitatively evaluate the extent of recall bias.

Population estimates also provide the opportunity to relate deer seen by hunters to population abundance. Understanding this relationship may assist in addressing future discussions on the effect of changing deer populations on hunter observations and satisfaction.

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. We are not able to estimate specific changes in harvest rate; however, we can observe whether any potential change in harvest rates affects the harvest age structure. For example, if antlered harvest rates on yearling bucks increase, we would expect to see a younger age structure in the harvest. Additional data collected from teeth from adult bucks during the 2010 and 2011 firearms season will be compared to results from the 2006 and 2007 firearms seasons.

Hunter Densities and Activity

We used results from the annual Game Take Survey to estimate the number of hunters and days spent hunting in the various deer seasons in each study WMU. 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 deer hunters and days spent deer hunting in each study WMU.

RESULTS

Deer Capture, Survival, and Mortality Causes

We captured 733 deer, including 104 recaptures (Table 1). Four hundred seventy deer were marked with reward tags, while 157 were marked with radio collars (Table 2). From July 2008-April 2009, 88 deer were lost to mortality (Table 3). Fifty-six (33 adult males and 23 adult females) of the mortalities occurred due to legal harvest in the 2G and 4B study areas. Other losses included unrecovered harvest (2), poaching (5), capture-related injuries (1), roadkilled (12), and natural causes (6). An additional 6 deer were lost to unknown causes.

Unbiased Population Estimates

Population estimates will require the 2009-10 hunting season, so none are available at this time.

Antlerless Harvest Success Rates and Effectiveness of 7-Day Season

Antlerless harvests declined in 3 of 4 experimental WMUs from 2007 to 2008 (Table 4). Only 2G remained stable. Harvests in the control units remained relatively stable. Catch-per-unit-effort in 2007 varied between 0.20 and 0.33 in the experimental units. In 2008, CPUEs varied between 0.17 and 0.28. Catch-per-unit-effort in the control WMUs remained stable or slightly increased.

Deer Hunting Experiences

We sent 2,356 deer hunter diaries to a random sample of deer hunters in control and experimental WMUs. Forty-one (2%) were undeliverable, and 45 (2%) were returned but filled out incorrectly with unusable data. One hundred thirty nine (6%) surveys were either filled out incorrectly or the hunters indicated they did not hunt. After adjusting for these non-response conditions, 1,152 of 2,131 surveys were returned by hunters for a 54% response rate.

Results from hunter diaries will be reported in the final report at the conclusion of this study.

Hunter Satisfaction

No survey to evaluate hunter satisfaction was conducted after the 2008-09 deer season. A survey will be conducted following the 2009-10 deer season.

Antlered Harvest Age Structure

The 2007 buck harvest age structure in the experimental units ranged from 39-60% yearlings, while in the control units, yearling composition ranged from 52-60% (Table 5). In 2008, yearling composition in the experimental units ranged from 38-60%, while in the control units yearling composition ranged from 39-62%.

Hunter Densities And Activity

No analyses were conducted from responses to the Game Take Survey to estimate the number of deer hunters and days spent deer hunting in each study WMU this field season.

RECOMMENDATIONS

1. Continue fieldwork to mark deer with reward tags and radio collars to estimate survival, mortality causes, and population abundance.

2. Continue to monitor antlerless deer CPUEs with a 7-day antlerless season.
3. As described in the project plan, the 2008 antlerless allocation should be maintained as the 2009 antlerless allocation in experimental WMUs 2D, 2G, 3C, and 4B and control WMUs 1A, 2F, 3A, and 4A.
4. Conduct deer hunter survey in WMUs 2D, 2G, 3C, and 4B in February 2010 to remain consistent with the pre-treatment survey conducted in February 2008.
5. Conduct survey of deer hunters using diaries in experimental and control units for the 2009 firearms deer season.
6. Continue to evaluate antlered harvest age structure in experimental and control units for the 2009 firearms season.
7. Use results of 2008-09 Game Take Survey to estimate number of deer hunters and days spent deer hunting in each of the experimental and control units during the 2008 firearms season.

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Table 1. White-tailed deer captures (including recaptures reported in parentheses) by sex and age class from January - April 2009 in WMUs 2D, 2G, 3C, and 4B, Pennsylvania. An adult is classified as an animal 1.5 years old or older.

Sex/age class	WMU				All captures
	2D	2G	3C	4B	
Male Adults	28 (3)	22 (5)	9 (1)	13 (0)	72 (9)
Male Fawns	45 (10)	23 (6)	28 (0)	55 (9)	151 (25)
Female Adults	63 (5)	65 (10)	53 (6)	56 (5)	237 (26)
Female Fawns	54 (14)	31 (3)	33 (18)	51 (9)	169 (44)
Total	190 (32)	141 (24)	123 (25)	175 (23)	629 (104)

Table 2. White-tailed deer captures (including recaptures), number of deer marked with reward ear tags and radio collars by WMU, January - April 2009, Pennsylvania. An adult is classified as an animal 1.5 years old or older.

WMU	Total captures ^a	Reward ear tags			Radio collars		
		Juvenile males	Adult males	Females	Juvenile males	Adult males	Females
2D	190 (32) ^b	39 (8)	18 (1)	85 (7)	15 (6)	10 (2)	23 (7)
2G	141 (24)	14 (2)	15 (2)	63 (10)	17 (1)	6 (2)	25 (7)
3C	123 (25)	26 (16)	4 (1)	62 (6)	7 (2)	5 (0)	19 (0)
4B	175 (23)	43 (9)	6 (0)	95 (9)	8 (0)	7 (0)	15 (5)
Total	629 (104)	122 (35)	43 (4)	305 (32)	47 (9)	28 (4)	82 (18)

^a Includes recaptures; this total is greater than sum of all sex/age classes.

^b Includes recapture of a doe ear tagged from a previous study which was neither collared nor tagged with a reward ear tag.

Table 3. Mortality causes for white-tailed deer in Pennsylvania, July 2008 - April 2009

Mortality cause	WMU				Total
	2D	2G	3C	4B	
Legal harvest	-- ^a	26	-- ^a	30	56
Male adults	-- ^a	15	-- ^a	18	33
Male fawns	-- ^b				
Female adults	-- ^a	11	-- ^a	12	23
Female fawns	-- ^b				
Unrecovered harvest	-- ^a	0	-- ^a	2	2
Male adults	-- ^a	0	-- ^a	2	2
Male fawns	-- ^b				
Female adults	-- ^a	0	-- ^a	0	0
Female fawns	-- ^b				
Poaching	0	2	0	3	5
Male adults	0	2	0	3	5
Male fawns	0	0	0	0	0
Female adults	0	0	0	0	0
Female fawns	0	0	0	0	0
Capture-related	1	0	0	0	1
Male adults	0	0	0	0	0
Male fawns	1	0	0	0	1
Female adults	0	0	0	0	0
Female fawns	0	0	0	0	0
Roadkill	0	4	0	8	12
Male adults	0	0	0	5	5
Male fawns	0	0	0	0	0
Female adults	0	3	0	2	7
Female fawns	0	1	0	1	2
Natural Causes	1	2	1	2	6
Male adults	1	1	0	0	2
Male fawns	0	0	1	0	1
Female adults	0	1	0	2	3
Female fawns	0	0	0	0	0
Unknown	0	2	1	3	6
Male adults	0	0	0	0	1
Male fawns	0	0	0	0	0
Female adults	0	2	1	3	5
Female fawns	0	0	0	0	0
Total	2	36	2	48	88
Male adults	1	18	1	28	48
Male fawns	1	0	1	0	2
Female adults	0	17	0	19	36
Female fawns	0	1	0	1	2

^a No deer were tagged in these WMUs.

^b Fawns less than 7 months-old are not marked during the hunting seasons.

Table 4. Estimated antlerless harvests, number of antlerless licenses sold, and catch-per-unit-effort (CPUE) by WMU, 2007-08 through 2008-09.

WMU	2007-08 ^a			2008-09 ^b		
	Harvest	Licenses sold	CPUE	Harvest	Licenses sold	CPUE
2D	18,100	55,365	0.33	15,600	55,294	0.28
2G	6,600	25,779	0.26	6,500	25,775	0.25
3C	9,600	26,804	0.36	7,300	26,884	0.27
4B	4,500	22,687	0.20	3,800	22,696	0.17
1A	12,500	41,353	0.30	12,600	41,603	0.30
2F	7,100	27,716	0.26	9,100	27,753	0.33
3A	7,800	28,392	0.27	7,500	25,540	0.29
4A	6,700	28,402	0.24	6,900	28,731	0.24

^a 12-day season in all 8 WMUs.

^b 7-day season in WMUs 2D, 2G, 3C, and 4B

Table 5. Harvest age structured of antlered deer by WMU, expressed as percentages, 2007-08 and 2008-09 hunting seasons.

WMU	2007-08 ^a		2008-09 ^b	
	1.5 yr old	2.5+ yr old	1.5 yr old	2.5+ yr old
2D	0.67	0.33	0.60	0.40
2G	0.39	0.61	0.38	0.62
3C	0.53	0.47	0.47	0.53
4B	0.60	0.40	0.57	0.43
1A	0.60	0.40	0.62	0.38
2F	0.58	0.42	0.50	0.50
3A	0.52	0.48	0.41	0.59
4A	0.56	0.44	0.39	0.61

^a 12-day season in all 8 WMUs

^b 7-day season in WMUs 2D, 2G, 3C, and 4B

Appendix 1. 2008-09 Deer hunter diary to determine changes in deer sightings and hunter activity, opinions, and satisfaction.

Pennsylvania Deer Hunter Diary – 2008 Firearms Season (December 1-12, 2008)

1. Which of the following licenses and stamps did you purchase for the 2008-09 hunting seasons? **(Circle all that apply)**
 1. GENERAL HUNTING LICENSE 2. JR or SR 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, AND ACTIVE MILITARY
 4. NO, I DID NOT HUNT DEER DURING ANY EARLY SEASONS

If YES, did you harvest any deer during these early seasons? 1. NO 2. YES, AN ANTLERED DEER 3. YES, _____ ANTLERLESS DEER
No. of deer

INSTRUCTIONS FOR COMPLETING HUNTER DIARY:

Each time you hunt deer during the rifle season (December 1-12, 2008), 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 18, 2008**. Your answers will remain confidential.

Pennsylvania Deer Hunter Diary – 2008 Firearms Season (December 1-12, 2008)

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
12/1	3B	Private	SGL	Other Public	4.5	1	2	1	YES	NO	0	1	0	YES	NO
		Private	SGL	Other Public					YES	NO				YES	NO
		Private	SGL	Other Public					YES	NO				YES	NO
		Private	SGL	Other Public					YES	NO				YES	NO
		Private	SGL	Other Public					YES	NO				YES	NO
		Private	SGL	Other Public					YES	NO				YES	NO
		Private	SGL	Other Public					YES	NO				YES	NO
		Private	SGL	Other Public					YES	NO				YES	NO
		Private	SGL	Other Public					YES	NO				YES	NO
		Private	SGL	Other Public					YES	NO				YES	NO
		Private	SGL	Other Public					YES	NO				YES	NO
		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 2008 rifle season

6. How do you rate your satisfaction with your hunting experience during the 2008 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