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TITLE: White-tailed Deer Research/Management

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TITLE: Deer Health, Forest Habitat Health, Deer Harvests, and Deer Population Trends by Wildlife Management Unit

PERIOD COVERED: 1 July 2008 through 30 June 2009

COOPERATING AGENCIES: Pennsylvania Cooperative Fish and Wildlife Research Unit, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania State University, and U.S. Forest Service

WORK LOCATION(S): Statewide

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ABSTRACT We monitored Wildlife Management Unit (WMU) deer health, forest habitat health, and deer population trends using reproductive parameters from road-killed does, advanced tree seedling and sapling regeneration from the Pennsylvania Regeneration Study, deer harvest estimates and compositions, and field studies. Deer health was judged to be "above target" in 5 WMUs and "at target" in 17 WMUs. Forest habitat health was judged to be good in 2 WMUs, fair in 15 WMUs, and poor in 4 WMUs. Hunters harvested 335,850 deer (122,410 antlered and 213,440 antlerless) in the 2008-09 deer seasons. Deer populations in most WMUs remained stable. Antlerless allocations were designed to reduce the population in 3 urban/suburban WMUs, increase the population in 2 WMUs, and keep the population steady in 17 WMUs. Allocations in 4 treatment WMUs (2D, 2G, 3C, and 4B) and their respective control WMUs (1A, 2F, 3A, and 4A) remained unchanged because of study design. We recommended the continuation of the 5-day antlered/7-day concurrent season in the 4 treatment WMUs being used for research until evaluation is complete. In all other WMUs, we recommend the continuation of current regulations to monitor deer populations, and modification of antlerless allocations to change the antlerless deer harvests.

OBJECTIVE

To monitor deer health, forest habitat health, deer harvests, and deer population trends by Wildlife Management Unit (WMU).

METHODS

Deer Health

To obtain data on deer health, Wildlife Conservation Officers (WCOs) and other personnel examined female deer killed by various causes from 1 February through 31 May 2008. They recorded location (county, township, and WMU), date killed, cause of death, and number and sex of embryos for each doe on a form attached to a deer jaw envelope. One side of the lower jaw was removed from each deer for age determination. Jaws were forwarded to Regional Wildlife Management Supervisors, who forwarded them to the Deer and Elk Section for ageing in June 2008. Personnel in the Bureau of Automated Technology Services (BATS) processed the reproductive data and provided summary reports for the state and each WMU.

Based on results from published studies (Cheatum and Severinghaus 1950, Verme 1965, Verme 1967, Verme 1969, Hesselton and Sauer 1973, Hesselton and Jackson 1974, McCullough 1979, Stoll and Parker 1986, Folk and Klinstra 1991, Osborne et al 1992, Taylor 1996, Swihart et al 1998), we used embryo counts per adult female (2-years-old and older) to assess deer health in each WMU. We chose a target of 1.50 embryos per adult female for deer to be considered healthy. Because of difficulties in gathering sufficient samples for 1-year-old females, 2-year-old females, and 3-year-old and older females, we combine 2-year-old and 3-year-old and older groups into a single group ("adult female"). This grouping also makes our data set comparable to previously published work. The value of 1.50 was chosen for the following reasons: 1) 1.50 embryos per adult female (2-year-old and older female) corresponds to a population producing at a high and sustainable level (Downing and Guynn 1985), 2) based on more than a dozen studies from the United States and Canada, a value of 1.50 embryos per adult female represents the middle ground between deer with low and high nutrition, and 3) 1.50 embryos per adult doe is achievable for WMUs in Pennsylvania. Studies used to assess the suitability of 1.50 embryos per adult female come from states and provinces including Michigan, Manitoba, Ohio, New York, and Pennsylvania.

Because our reproduction point estimate is based on a sample, we conducted a two-tailed *t* test for differences between the sample mean and our target of 1.50 embryos per adult female. We believe this approach is better than using a strict cutoff because it provides a framework to assess not only the point estimates, but also variation.

Decision Rules Used to Determine Deer Health.--

1. Does 3-year estimate of embryos per adult female have a coefficient of variation (CV) of ≤ 13%[a]?

    a. YES. Is the WMU's point estimate of embryos per adult female statistically different from 1.50?

        i. NO. Deer health is "at target".

        ii. YES. Is the point estimate above 1.50?
            1. YES. Deer health is "above target".
            2. NO. Deer health is "below target".

b. NO. Larger sample sizes are needed to achieve desired levels of estimator precision. Deer health will be assessed based on point estimate and small sample size noted.

[a] – A coefficient of variation (CV) of approximately <13% is considered sufficient for accurate population management (Skalski and Millspaugh 2002, Skalski et al. 2005, Millspaugh et al. 2006). At this time, it typically requires pooling of 3 years of data to achieve CVs of less than 13%.

Forest Habitat Health

We used forest regeneration to assess forest habitat health. Forest regeneration is not just a measure for the benefit of the forest, but also for deer and wildlife. For deer, seedling and sapling trees provide food and cover. As a result, measuring regeneration is an important measure of the sustainability of a forest, and available food and cover that benefit deer and other wildlife.

To obtain data on forest regeneration, advanced tree seedling and sapling regeneration (ATSSR) data are collected as part of a systematic sampling scheme from public and private lands in WMUs from the Pennsylvania Regeneration Study. This study is being conducted as part of the Forest Inventory Analysis (FIA) by Pennsylvania Department of Conservation and Natural Resources (DCNR), Pennsylvania State University (PSU), and U.S. Forest Service (USFS). Subsets of all plots are collected each year, with a complete sampling of plots occurring every 5 years. ATSSR from 2 groupings of tree species are available from the Pennsylvania Regeneration Study. The measure selected for use in deer management is the grouping of dominant canopy species and species capable of achieving high canopy status. "The composition of the ATSSR has a direct impact on the future composition of the forest overstory (Marquis and others 1994). To cover the range of future forest character and client needs 2 composition groupings are used. The first groups tree species by preference for timber management. The second composition grouping represents the forest's ability to regenerate the existing dominant canopy. Dominant species include those that contribute at least 2% of the State's total-tree biomass and are able to grow into the existing canopy; Other High Canopy species include all others that are capable of attaining canopy dominance" (McWilliams et al. 2004).

We requested ATSSR data for dominant canopy species and species capable of achieving high canopy status by WMU from the USFS and DCNR. Determination of adequate regeneration was based on levels of deer browse impact observed in the area of each plot. For example, a greater number of saplings are required to replace the existing canopy where deer impact is "very high" compared to fewer saplings required where deer impact is "very low". The scaled levels of deer impact indicate deer population size in relation to food availability in a given area (i.e., carrying capacity). Areas with ample food to support the local deer population will be evident by very low to medium deer impact. Areas lacking food to support the local deer population will be evident by high to very high deer impact. These critical stocking guidelines were derived from extensive literature reviews and decades of research on deer-habitat interactions (Marquis et al. 1992). In 2008 we began using browse impact and associated stocking levels in the habitat health measure. Because of the sampling scheme used in the Pennsylvania Regeneration Study, it takes 5 years to visit all sample plots.

Based on input from cooperating agencies that designed and conduct the Pennsylvania Regeneration Study and an internal Game Commission review of the forest habitat health measure, we defined forest habitat as “good” if 70% or more of the sampled plots contained adequate regeneration. If less than 50% of the plots contained adequate regeneration, forest habitat health was considered “poor”. “Fair” falls between levels for “good” and “poor”.

Similar to the deer health measure, the forest habitat health measure is based on a sample of plots from across a WMU and we use a statistical test to assess regeneration levels. By using a statistical test to assess differences from predetermined levels (e.g., 70%), we take into account both the point estimate and associated variation.

When data are collected according to proper sampling design, estimates can be statistically compared to 50% and 70% levels using a t-test. The t-test determines whether the estimate is different from the 50% or 70% level based on standard statistical procedures. Since reliability of statistical tests is related to sample sizes, forest habitat health determinations are made based on 5-year data sets to maximize sample size and reliability of statistical tests.

Decision Rules Used to Determine Forest Habitat Health.--We developed a set of criteria to assign a value of “Good”, “Fair”, or “Poor” for forest habitat health. A WMU’s forest habitat health was considered “good” if the observed percentage of plots with adequate regeneration was greater than, equal to, or not significantly different than 70%. If a WMU’s forest habitat health was not significantly different from 70% and not significantly different from 50%, then forest habitat health was considered “fair”. A WMU’s forest habitat health also was considered “fair” if: 1) the observed percentage of plots with adequate regeneration was equal to 50%; or 2) between 50% and 70% and significantly less than 70%; or 3) not significantly different than 50%. A WMU’s forest habitat health was considered “poor” if the observed percentage of plots with adequate regeneration was significantly less than 50%.

Deer Harvest Estimates and Composition

To estimate deer harvests and collect data for monitoring deer population trends, 33 data collection teams examined deer in assigned areas across the state. Each team collected data for 3 days during the first week of the regular firearms season, 2 days during the second week of the season, and 2 days after the close of the season. Data collected included age, sex, location of harvest (WMU, county, and township), and hunting license number from ear tags. Deer teams determined deer age as 6 months (fawn), 18 months (yearling), or at least 30 months (adult) using tooth wear and replacement (Severinghaus 1949). Data collection teams also recorded points of antlers to determine antler characteristics by age class.

A data entry company was contracted to enter deer aging and harvest report card data. BATS validated and processed harvest data and ran harvest data analysis programs. For each WMU the analyses included: the number of antlered and antlerless deer checked by aging teams, the number of antlered and antlerless deer checked by deer aging teams and reported by hunters, the total number of antlered and antlerless deer reported by hunters, age and sex composition of the harvest, and reported regular firearms, muzzleloader, and archery harvests.

Deer harvests were estimated using mark-recapture methods. When estimating deer harvests, we used a closed, 2-sample Lincoln-Petersen estimator where deer were considered marked when they were checked in the field by deer aging teams. Recapture occurred when marked deer were reported on report cards sent in by hunters.

Because reporting rates in Pennsylvania vary by year, antlered and antlerless deer, and WMU (Rosenberry et al. 2004), deer harvest estimates were calculated for antlered and antlerless deer in each WMU using Chapman's (1951) modified Lincoln-Petersen estimator. This estimator is recommended (Nichols and Dickman 1996) because it has less bias than the original Lincoln-Petersen estimator (Chapman 1951).

Deer Population Trends

We used multiple methods to monitor deer population trends including a modified sex-age-kill (SAK) model (Eberhardt 1960, Creed et al. 1984, Skalski and Millspaugh 2002), antlerless hunter success index (i.e., estimated antlerless harvest divided by the number of antlerless licenses), and an antlered harvest index (i.e., estimated antlered harvest for a WMU).

We modified the standard SAK model to account for Pennsylvania’s antler restrictions to monitor deer population trends. Modifications involve estimation of 1.5-year-old and 2.5-year-old and older male populations. Population trend monitoring relies on research data from Pennsylvania (e.g., Long et al. 2005), harvest estimates, and deer aging data. Population monitoring began with adult males (males 1.5 years of age and older) and progressed to females and fawns.

The modified SAK procedure began by estimating males 2.5 years of age and older from harvest estimates and adult male harvest rates. Once the population of males 2.5 years of age and older were estimated, we determined the 1.5-year-old male population. Because protection levels of 1.5-year-old males varied among WMUs and harvest rates could also vary, we worked back in time to generate harvest rates for 1.5-year-old males. First, we determined the pre-hunt population of 1.5-year-old males in the preceding year using current year population estimate of 2.5-year-old males, survival rate from 1.5 to 2.5 years of age, and estimated harvest of 1.5-year-old males in the preceding year. Harvest rate of 1.5-year-old males from the preceding year was then calculated using the pre-hunt population and estimated harvest of 1.5-year-old males. Current year’s population of 1.5-year-old males was determined using a 3-year running average of harvest rates of 1.5-year-old males from the 3 previous years. Following determination of the 1.5-year-old males and males 2.5 years of age and older, calculation of female, fawn, and the total populations followed procedures similar to Skalski and Millspaugh (2002).

When interpreting results from the modified SAK procedure, it is important to know that due to the nature of population reconstruction methods, such as those used in the SAK procedure, the most accurate population estimate for a particular year occurs at some point in the future when data for each cohort of deer is complete (Skalski et al. 2005). Consequently, for the most recent years, population numbers should be viewed as indices rather than estimates (Skalski et al. 2005). Second, due to necessary assumptions of this population monitoring procedure, population numbers used to assess trends should be viewed as relative (i.e., whether trends are increasing, decreasing, or remaining stable), not absolute numbers. As we accumulate more years of data and results from on-going internal and external evaluations, refinements to this procedure will occur.

Population trends are reported as changes from year to year (λ) and are calculated as $\lambda = \frac{\hat{N}_{t+1}}{\hat{N}_t}$ where $\hat{N}_{t+1}$ is the deer population in year *t+1* and $\hat{N}_t$ is the deer population in year *t* (Skalski et al. 2005). A value of λ = 1.00 would indicate no change in deer population. Values greater than 1.00 indicate increases and values less than 1.00 indicate decreases. Deer management objectives and recommendations are based on population trends. As a result, we do not make management recommendations in response to individual λs, but rather we based management recommendations on multi-year trends.

We identified population trends as increasing, decreasing, or stable based on graphical and statistical methods, specifically the Mann-Kendall Test for Trend (Mann 1945, Kendall and Gibbons 1990). We chose this test because it provides a statistical test of trend in data without complex calculations and does not require actual differences between years. Since effective state agency deer programs must consider public involvement and perceptions, it is important that we assess trends with a test that is statistically appropriate, utilizes information available to the public (e.g., a graph of estimates over time), and is relatively easy to explain.

RESULTS

Deer Health

WCOs examined 1,020 females during the 2008 pre-fawning season. Five hundred and ninety-eight were pregnant. Twenty-six percent of the fawns, and 93% of the adults were pregnant. Pregnant fawns averaged 1.22 embryos/female. Pregnant adults averaged 1.81 embryos/female. The average reproductive rates for pregnant and barren fawns and adults were 0.32 and 1.60 embryos/female, respectively. The average reproductive rate for all females was 0.99 embryos/doe. (Table 1).

WMU deer health assessments were based on reproduction from 3 consecutive years, 2006 to 2008. We pooled these 3 years because annual sample sizes are too small to make reliable inferences. Of 22 WMUS, we identified 5 with “above target” deer health, and the remaining 17with “at target” deer health (Table 2).

Forest Habitat Health

WMU forest habitat health assessments were based on the 5 years of the Pennsylvania Regeneration Study from 2004 to 2008. We identified 2 WMUs with good forest habitat health, 15 with fair forest habitat health, and 4 with poor forest habitat health (Table 3). One unit, 5D, does not have data to make an assessment. Results from this report can be compared to the 2007-08 report, but not to previous reports because of the addition of deer browse impact in assessing regeneration adequacy.

Deer Harvest Estimates and Composition

Pennsylvania Game Commission (PGC) personnel checked an average of 400 (range: 35 to 739) antlered deer and 785 (range: 151 to 2016) antlerless deer per WMU during the 2008 firearms season (Table 4). Based on deer checked and report cards sent in by successful hunters, hunters harvested an estimated 335,850 deer in the 2008-09 deer seasons (Table 4). The antlered harvest was 122,410, an increase of 12% from the 2007-08 harvest of 109,200. The antlerless harvest was 213,440, almost identical to the harvest of 213,870 in 2007-08.

Antlered harvests were composed of 52% 1.5-year-old males and 48% 2.5-year-old and older males (Table 5). Compared to years prior to implementation of antler restrictions during the 2002-03 hunting seasons, the age structure of the antlered harvest has increased, as has the number of 2.5-year-old and older bucks harvested (Table 5). Antlerless harvest composition has changed little since 1997-98 hunting seasons (Table 6).

Deer Population Trends

Population changes (λs) for 13 WMUs were between 0.90 and 1.10 from 2007 to 2008 based on preliminary population estimates for 2008 (Table 7). Since 2004, most WMU populations have remained relatively stable.

Deer Management Recommendations

Most deer hunting seasons and regulations will remain in place for the 2009-10 hunting seasons. These regulations include a 12-day concurrent antlered and antlerless firearms season for all hunters; a 7-day antlerless muzzleloader season in October; a 3-day antlerless rifle season in October for junior, senior, disabled, and military license holders; sale of unsold antlerless licenses, up to 2 per hunter, that remain after all hunters have had an opportunity to purchase one; and field possession regulations that allow a hunter to harvest another deer after tagging the first deer harvested. The Board of Commissioners again approved a 5 day antlered and 7 day concurrent firearms season in WMUs 2D, 2G, 3C, and 4B in place of the 12-day concurrent firearms season. We are currently collecting research data to evaluate the social and biological impacts of this season. The most significant change to deer management regulations occurred when the Board voted to allow use of crossbows statewide during all seasons for all species, including deer during the archery season.

The Board also approved the 2009-10 antlerless deer license allocation (Table 8). Allocations were intended to hold WMU population trends stable in 17 units, allow increases in 2 WMUs, and decreases in 3 units. Reducing deer populations in WMUs 2B, 5C, and 5D remained the objective. As called for in the research plan, treatment WMUs 2D, 2G, 3C, and 4B and their matching control WMUs 1A, 2F, 3A, and 4A (respectively) will have antlerless allocation identical to 2008-09 to evaluate the effectiveness of the 5/7 season format. In year 3 and 4 of this study, allocations will be modified as necessary to achieve management goals.

RECOMMENDATIONS

1. Increase annual WMU sample sizes of females collected for monitoring deer health and plots for monitoring forest habitat health.

2. Identify and develop additional analyses and measurements to improve the forest habitat health measure’s ability to account for factors other than deer that affect forest regeneration and to most directly monitor deer impacts on forest regeneration.

3. Maintain deer aging sampling effort. Current numbers of deer checked in the field provide reasonably precise harvest estimates in most WMUs. Harvest estimates are least precise in smaller WMUs where it is more difficult to collect sufficient data.

4. Continue to evaluate validity of assumptions and population monitoring procedures through internal and external peer-review. Prioritize research needs based on internal and external reviews.

5. Continue the 5-day antlered/7-day concurrent firearms season in WMUs 2D, 2G, 3C, and 4B to allow for further collection of research data. As called for in the research proposal, allocations in 2009-10 (year 2 of the study) will be identical to allocations in 2008-09 in experimental WMUs 2D, 2G, 3C, and 4B, as well as control WMUs 1A, 2F, 3A, and 4A.

6. Continue concurrent antlered and antlerless firearms seasons for all WMUs except 2D, 2G, 3C, and 4B. This provides more hunting opportunities to hunters and maintains consistency in hunting seasons that is important to monitoring population trends. In addition, the antlerless allocation can control the antlerless harvest without changing season length.

7. Continue antler restriction regulations to allow rigorous evaluation of their effects on the deer population and changes in hunter support over time.

8. Continue to allow hunters to purchase and use the entire antlerless allocation.

9. Continue to allocate antlerless licenses designed to achieve deer management goals as defined in the deer management plan.

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Table 1. Number of females examined, median conception date for females with conception date data, percent of females bred between 16 October and 16 December, mean embryos per adult female (≥ 2 years of age), and adult female pregnancy rates from 2000 to 2008, Pennsylvania. NOTE: This information is provided for public information, but is not used to make deer management recommendations. WMU level data is used for management recommendations.

Year	***n***	**Median conception date**	**Percent bred 16 October to 16 December**	**Mean embryos per adult female**[a]	**Adult female pregnancy rates (%)**[a]
2000	1,075	14 November	90	1.60	93
2001	942	17 November	91	1.58	93
2002	520	14 November	86	1.63	93
2003	618	14 November	93	1.59	93
2004	601	15 November	90	1.53	91
2005	883	14 November	90	1.51	92
2006	632	11 November	89	1.54	89
2007 [b]	1,003	16 November	92	1.50	88
2008	1,020	---	---	1.60	93

[a] Embryo counts and pregnancy rates adjusted to account for females that were lactating when collected in late spring. As a result of this change, these results may not agree with previous reports.
[b] Final year for conception date research.

Table 2. Number of adult does examined and assessment of deer health by WMU based on samples collected from 2006 to 2008, Pennsylvania.

WMU	***n***	**Embryos per adult female**	**Deer health assessment**
1A	84	1.44	AT TARGET
1B	57	1.58	AT TARGET
2A	80	1.33	AT TARGET
2B	137	1.67	ABOVE TARGET
2C	132	1.55	AT TARGET
2D	100	1.65	ABOVE TARGET
2E	30	1.73	AT TARGET
2F	87	1.47	AT TARGET
2G	41	1.66	AT TARGET
3A	23	1.78	ABOVE TARGET
3B	66	1.32	AT TARGET
3C	32	1.50	AT TARGET
3D	77	1.34	AT TARGET
4A	100	1.43	AT TARGET
4B	51	1.51	AT TARGET
4C	54	1.41	AT TARGET
4D	72	1.69	ABOVE TARGET
4E	51	1.78	ABOVE TARGET
5A	37	1.62	AT TARGET
5B	61	1.64	AT TARGET
5C	74	1.61	AT TARGET
5D	32	1.69	AT TARGET

Table 3. Number of plots sampled, percent with adequate regeneration, and qualitative assessment of forest habitat health by WMU. Data are based on samples collected from 2004 to 2008, Pennsylvania. Results cannot be compared to previous reports because of changes in methods.

WMU	***n***	**% plots with adequate regeneration**	**Forest health assessment**
1A	16	51	Fair
1B	21	37	Poor
2A	19	36	Fair
2B	11	59	Fair
2C	44	56	Fair
2D	29	49	Fair
2E	15	47	Fair
2F	40	39	Fair
2G	64	38	Poor
3A	18	55	Fair
3B	43	63	Good
3C	24	60	Fair
3D	32	45	Fair
4A	21	64	Fair
4B	18	63	Fair
4C	19	50	Fair
4D	26	34	Poor
4E	12	61	Fair
5A	4	67	Good
5B	8	52	Fair
5C	10	29	Poor
5D	1	No Data	--

Table 4. Number of deer checked by PGC personnel, number of report cards sent in by successful hunters, and estimated harvests for antlered and antlerless deer by WMU, Pennsylvania, 2008-09.

	Antlered			**Antlerless**		
WMU	**Deer checked**	**Report cards**	**Harvest**[1]	**Deer checked**	**Report cards**	**Harvest**[a]
1A	366	1,821	5,400	1,186	4,759	12,600
1B	652	2,126	7,500	2,016	4,414	13,400
2A	321	2,126	6,700	1,130	4,774	15,300
2B	141	1,451	4,000	586	4,442	15,300
2C	548	3,104	7,500	1,212	5,056	12,800
2D	568	3,308	9,500	1,148	5,929	15,600
2E	304	1,421	5,000	418	2,108	6,200
2F	739	2,427	7,000	1,023	3,160	9,100
2G	559	2,874	6,800	299	2,325	6,500
3A	380	1,431	4,100	751	2,943	7,500
3B	529	1,991	5,500	1,019	3,691	9,900
3C	548	2,313	6,300	527	2,845	7,300
3D	293	1,392	3,900	613	2,774	6,900
4A	310	1,588	4,200	498	2,782	6,900
4B	328	1,583	3,900	293	1,543	3,800
4C	366	2,104	5,000	739	3,373	8,000
4D	522	2,407	6,600	899	3,444	9,300
4E	331	1,697	4,300	670	2,851	7,200
5A	101	927	2,100	186	1,636	3,800
5B	416	2,740	6,800	915	5,103	11,200
5C	434	3,491	8,700	987	9,934	20,200
5D	35	559	1,300	151	2,415	4,500
Unk.		114	310		55	140

[a] Estimated harvests are rounded to the nearest 100 or 1,000 based on precision of harvest estimate. Unknown WMU harvests are rounded to the nearest 10 due to the small number.

Table 5. Number of antlered deer aged, age composition of harvests, and approximate number of 2.5-year-old and older males harvested in Pennsylvania, 1997-98 to 2008-09. Three and 4-point antler restrictions started in 2002-03. Percentages may not add up to 100 percent due to rounding.

Year	***n***	**% 1.5-year-old males**	**% 2.5-year-old and older males**	**No. of 2.5-year-old and older males harvested**
1997-98	18,563	81	19	33,600
1998-99	21,350	81	19	34,500
1999-00	20,011	80	20	38,900
2000-01	22,145	82	18	36,600
2001-02	18,893	78	22	44,700
2002-03	11,688	68	32	52,900
2003-04	11,367	56	44	62,600
2004-05	10,555	50	50	62,000
2005-06	9,062	52	48	57,800
2006-07	10,819	56	44	59,500
2007-08	8,014	56	44	48,000
2008-09	9,357	52	48	59,200

Table 6. Number of antlerless deer aged and age composition of harvests in Pennsylvania, 1997-98 to 2008-09. Percentages may not add up to 100 percent due to rounding.

Year	***n***	**% 0.5-year-old males**	**% 0.5-year-old females**	**% 1.5-year-old and older females**
1997-98	28,743	24	20	56
1998-99	24,913	23	20	57
1999-00	18,502	24	20	56
2000-01	30,460	22	20	58
2001-02	25,450	22	18	60
2002-03	30,077	22	18	60
2003-04	28,236	21	18	61
2004-05	24,640	22	18	61
2005-06	19,459	23	19	58
2006-07	19,074	23	19	58
2007-08	17,770	24	20	56
2008-09	17,152	22	18	60

Table 7. Change (λ[a]) in deer density by WMU, 2004 to 2007, Pennsylvania[b]

WMU	2004	2005	2006	2007	2008
1A	0.96	1.03	1.12	0.72	0.98
1B	0.96	1.05	1.07	0.95	1.03
2A	0.97	1.01	0.93	0.91	0.96
2B	1.07	1.07	1.12	0.78	0.83
2C	0.85	0.96	1.03	1.10	0.94
2D	0.92	0.96	1.02	0.88	1.05
2E	0.83	1.14	0.88	0.91	1.08
2F	0.90	0.88	0.93	0.85	1.06
2G	0.89	0.95	1.06	0.77	1.26
3A	1.00	0.95	0.90	0.97	0.72
3B	1.00	0.94	0.96	1.09	0.72
3C	0.90	0.92	1.10	0.83	0.85
3D	0.87	0.94	0.95	0.95	0.95
4A	0.90	0.78	1.35	1.29	0.62
4B	0.89	0.83	1.24	0.80	1.09
4C	1.03	0.90	0.97	0.87	0.95
4D	0.85	0.90	1.14	0.82	1.14
4E	0.88	1.08	0.83	0.93	0.82
5A	1.00	0.81	1.07	1.06	1.03
5B	0.91	0.96	1.04	0.87	1.01
5C	0.97	1.03	0.92	0.94	0.85
5D	1.13	0.83	0.79	0.83	0.94

[a] λ = 1.00 indicates no change in deer density. Values greater than 1.00 indicate increases, less than 1.00 indicate decreases.

[b] λs from prior years may not match λs previously reported because λs are updated as new harvest and population data become available.

Table 8. Antlerless license allocations by WMU, 2004-05 to 2009-10, Pennsylvania.

WMU	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
1A	48,000	40,000	42,000	42,000	42,000	42,000
1B	33,000	27,000	30,000	30,000	30,000	30,000
2A	55,000	55,000	55,000	60,000	55,000	55,000
2B	68,000	68,000	68,000	68,000	68,000	68,000
2C	75,000	53,000	49,000	49,000	49,000	49,000
2D	58,000	56,000	56,000	56,000	56,000	56,000
2E	23,000	21,000	21,000	21,000	21,000	21,000
2F	44,000	30,000	28,000	28,000	28,000	28,000
2G	52,000	29,000	19,000	26,000	26,000	26,000
3A	32,000	27,000	29,000	29,000	26,000	26,000
3B	48,000	41,000	43,000	43,000	43,000	43,000
3C	37,000	32,000	27,000	27,000	27,000	27,000
3D	50,000	38,000	38,000	38,000	37,000	37,000
4A	43,000	35,000	29,000	29,000	29,000	29,000
4B	49,000	35,000	31,000	23,000	23,000	23,000
4C	44,000	39,000	39,000	39,000	35,000	35,000
4D	55,000	40,000	40,000	40,000	40,000	40,000
4E	38,000	38,000	38,000	38,000	30,000	30,000
5A	32,000	28,000	25,000	22,000	19,000	19,000
5B	64,000	56,000	53,000	53,000	51,000	51,000
5C	71,000	71,000	79,000	84,000	92,000	113,000
5D	20,000	20,000	20,000	20,000	22,000	22,000