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

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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

PREPARED BY: Bureau of Wildlife Management (Christopher Rosenberry, Bret Wallingford, and Jeannine Tardiff Fleegle); Bureau of Wildlife Habitat Management (Dave Gustafson and Ben Jones).

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ABSTRACT We monitored Wildlife Management Unit (WMU) deer health, forest habitat health, and deer population trends using advanced tree seedling and sapling regeneration from the Pennsylvania Regeneration Study, deer harvest estimates and compositions, and field studies. We modified measures of deer health and forest health this year. Proportion of juveniles in the antlerless harvest replaced embryo counts and plots with greater than 75% stocking were added to the regeneration measure. These changes followed recommendations of the legislatively-sponsored audit of the deer program (Wildlife Management Institute 2010). Proportion of juveniles in the antlerless harvest has remained stable in all WMUs since 2003. Forest habitat health was judged to be good in no WMUs, fair in 16 WMUs, and poor in 3 WMUs. Three WMUs (2B, 5C, and 5D) were not included in the forest habitat health assessment because of high levels of human development. Hunters harvested 316,240 deer (122,930 antlered and 193,310 antlerless) in the 2010-11 deer seasons. Deer populations in most WMUs remained stable. The Board of Commissioners set antlerless allocations to stabilize deer populations in 14 WMUS, decrease deer populations in 5 WMUs, and increase deer populations in 3 WMUs. The antler restriction in the 4-point area was changed to be 3 points to an antler not including the brow tine.

OBJECTIVE

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

METHODS

Deer Health

Although embryo counts were not used to assess deer health, we report results from 2010, the final year of data collection. 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 2010. 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 2010. Personnel in the Bureau of Automated Technology Services (BATS) processed the reproductive data and provided summary reports for the state and each WMU.

Following their review of the PGC's deer herd health goal, WMI recommended replacing embryos per mature female or discontinuing deer herd productivity assessment (Wildlife Management Institute 2010). The most preferred alternative to replace embryos per mature female was proportion of juveniles in the antlerless harvest. The reasons WMI recommended replacing or discontinuing use of embryos per mature female was that embryos per mature female did not appear sensitive to differences in deer population and habitat characteristics, and there were inadequate annual sample sizes for all age classes in 22 WMUs. As a result, we assessed reproductive data using a 3-year running average. Larger, annual sample sizes for proportion of juveniles in the antlerless harvest were available by WMU and could solve the sample size problem.

Harvest age ratios also may provide an index to predator impacts on deer populations (Williamson 2003, Kilgo et al 2010). Predators kill most white-tailed deer during the first 3 months of life (Ballard et al. 2001). In Pennsylvania, coyotes (*Canis latrans*) and black bears (*Ursus americanus*) killed similar numbers of fawns, but predator-caused mortalities of deer older than 3 months was rarely observed (Vreeland et al. 2004, Keenan 2010, Norton 2010). Consequently, collecting data on the proportion of juveniles in the antlerless harvest when deer are >3 months of age may provide an index to recruitment after most predator-caused mortalities have occurred.

Based on population simulations, we chose to evaluate the trends in proportion of juveniles in the antlerless harvest rather than identify a single target value. Depending on juvenile survival and antlerless harvest rates, the proportion of juveniles in a population with a stable trend could vary substantially, and a single threshold value of proportion of juveniles in the population could correspond to increasing, decreasing, or stable deer population trend. As a result, a single threshold value for the proportion of juveniles in the antlerless harvest cannot be interpreted to suggest that a particular management response is warranted. Monitoring trends of

proportions of juveniles in the antlerless harvest also permits independent evaluation based on the population dynamics of each WMU. As a result, monitoring trends uses WMU-specific information compared to establishing a universal threshold value.

We identified proportion of juveniles in the antlerless harvest 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.

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).

Based on recommendations from WMI (Wildlife Management Institute 2010), more plots were included in our analysis of forest regeneration. From 2006 to 2010, only data from plots that were 40 to 75 percent stocked were analyzed. Beginning in 2011, data from all forested plots were analyzed.

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 higher count of seedling and sapling regeneration is required to replace the existing canopy

where deer impact is "very high" compared to a lower count of seedling and sapling regeneration 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 were recorded electronically on Pendragon Forms 5.1 software using a Windows Mobile hand-held computer (Trimble Nomad), and downloaded to a Harrisburg data collection point. 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 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 a modified Sex-Age-Kill (SAK) model to account for Pennsylvania's antler restrictions to monitor deer population trends (i.e., Pennsylvania Sex-Age-Kill (PASAK) model, Norton 2010, Rosenberry et al. 2011). 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, Keenan 2010, Norton 2010), harvest estimates, and deer aging data. Population monitoring began with mature males (males 1.5 years of age and older) and progressed to females and fawns. Step-by-step methods and results of the PASAK model were presented to the Board of Commissioners at the January 2011 meeting and posted on the Game Commission's website (Rosenberry et al. 2011).

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

Pennsylvania Game Commission (PGC) personnel examined 917 females during the 2010 pre-fawning season. Five hundred and forty-three were pregnant. Twenty-four percent of

the fawns, and 89% of the adults were pregnant or lactating. Pregnant fawns averaged 1.20 embryos/female. Pregnant adults averaged 1.75 embryos/female. The average reproductive rates for pregnant and barren fawns and adults were 0.28 and 1.53 embryos/female, respectively. The average reproductive rate for all females was 0.99 embryos/doe (Table 1).

Age data from more than 14,000 antlerless deer were used to assess proportion of juveniles in the antlerless harvest. Proportion of juveniles in the antlerless harvest ranged from a low of 0.31 in WMU 3D to a high of 0.48 in WMU 5D (Table 2). All WMUs exhibited stable trends from 2003 to the present.

Forest Habitat Health

WMU forest habitat health assessments were based on the 5 years of the Pennsylvania Regeneration Study from 2006 to 2010. We identified no WMUs with good forest habitat health, 16 with fair forest habitat health, and 3 with poor forest habitat health (Table 3). In 3 highly developed WMUs (i.e., 2B, 5C, and 5D) regeneration data were not used or considered in making deer management recommendations. Results from this report cannot be compared to previous years' reports. In reports from 2006 to 2010, only plots with 40 to 75% stocking levels were analyzed. In this year's report, plots with more than 40% stocking levels were analyzed.

Deer Harvest Estimates and Composition

PGC personnel checked an average of 384 (range: 34 to 620) antlered deer and 688 (range: 169 to 1,472) antlerless deer per WMU during the 2010 firearms season (Table 4). Based on deer checked and report cards sent in by successful hunters, hunters harvested an estimated 316,240 deer in the 2010-11 deer seasons (Table 4). The antlered harvest was 122,930, an increase of 13% from the 2009-10 harvest of 108,330. The antlerless harvest was 193,310, a decrease of 4% compared to the harvest of 200,590 in 2009-10.

Antlered harvests were composed of 48% 1.5-year-old males and 52% 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

Based on PASAK model results, deer population trends were stable in 20 WMUs and declining in 2 WMUs from 2005 to 2010 (Table 7).

Deer Management Recommendations

Except for the 4 WMUs (WMUs 2D, 2G, 3C, and 4B) where a research program was started in 2008, we continue to recommend consistent regulations that provide more hunting opportunities and use antlerless allocations to adjust antlerless harvests and population trends. Consistent regulations reduce uncertainty when interpreting changes in harvests and population parameters. These regulations include a 12-day concurrent antlered and antlerless firearms season for all hunters (excluding WMUs 2D, 2G, 3C, and 4B); 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. We also recommended a 5 day antlered and 7 day concurrent firearms season in WMUs 2D, 2G, 3C, and 4B remain in place until completion of a 4-year research program to evaluate the social and biological impacts of this season have been completed. For antlerless allocations, we provided the Board of Commissioners with allocation options that would increase, decrease, or stabilize the deer population with either a 5-day antlered and 7-day concurrent firearms season or a 12-day concurrent firearm season. To assist the Board of Commissioners in their decisions, we provided measures of deer health (i.e., proportion of juveniles in the antlerless harvest and population trend), forest habitat health (i.e., percent plots with adequate regeneration), and deer-human conflicts (i.e., Citizen Advisory Committee recommendations).

Action by the Board of Commissioners

The Board of Commissioners modified the firearms season in WMUs 2A, 2F, and 3B to a 5-day antlered/7-day concurrent season split format. For the 2011-12 hunting seasons, 11 WMUs will have the split format (WMUs 2A, 2C, 2D, 2E, 2F, 2G, 3B, 3C, 4B, 4D and 4E). The Board of Commissioners approved antlerless allocations to stabilize the deer population in 14 WMUs and to decrease deer populations in 4 WMUs (2B, 3D, 5C, and 5D). The approved antlerless allocations included increases to counter the expected reduction in antlerless hunter success rates due to the 5-day antlered/7-day concurrent season split format in WMUs 2A, 2C, 2E, 2F, 2G, 3C, and 4B. In WMU 2D, the approved allocation of 60,000 falls between stabilize and decrease allocation levels. A Citizens' Advisory Committee in WMU 2D recommended a population decrease. In WMUs 3B, 4D, and 4E, approved allocations fall between stabilize and increase allocation levels. The approved antlerless allocations increased allocations from 2010-11 to 2011-12 season in 20 WMUs (Table 8). The Board of Commissioners also changed the antler restriction in the 4-point WMUs. A buck with 3 points, not including the brow tine, will now be legal for harvest in WMUs 1A, 1B, 2A, 2B, and 2D.

RECOMMENDATIONS

1. Further refine methods of incorporating proportion of juveniles in the antlerless harvest into the deer management recommendations.

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 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. Complete the field study on the 5-day antlered/7-day concurrent firearm season in WMUs 2D, 2G, 3C, and 4B. Season and allocations changes to both treatment and control WMUs in the last 2 years will limit our conclusions on some research objectives.

6. Return to 12-day concurrent antlered and antlerless firearms seasons for all WMUs or adjust antlerless allocations as needed. The 12-day concurrent firearm season 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 in accordance with goals and objectives of the 2009-2018 deer management plan. Monitor changes to antler restrictions in WMUs 1A, 1B, 2A, 2B, and 2D using harvest age structure data and antler characteristics.

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

9. Set antlerless license allocations 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 2010, 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
2009	1,307	---	---	1.60	89
2010	917	---	---	1.53	89

[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 antlerless deer examined, proportion of juveniles in the antlerless harvest, and trend in the proportion of juveniles in the antlerless harvest by WMU from 2003 to 2010, Pennsylvania, 2010.

WMU	*n*	Proportion of juveniles in antlerless harvest	Trend
1A	858	0.46	Stable
1B	1,448	0.44	Stable
2A	884	0.36	Stable
2B	446	0.47	Stable
2C	723	0.40	Stable
2D	1,070	0.42	Stable
2E	325	0.46	Stable
2F	753	0.39	Stable
2G	169	0.37	Stable
3A	590	0.42	Stable
3B	860	0.40	Stable
3C	458	0.32	Stable
3D	504	0.31	Stable
4A	505	0.32	Stable
4B	472	0.38	Stable
4C	831	0.42	Stable
4D	416	0.39	Stable
4E	597	0.44	Stable
5A	184	0.43	Stable
5B	1,206	0.41	Stable
5C	1,359	0.43	Stable
5D	179	0.48	Stable

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 2006 to 2010, Pennsylvania. Results are based on all forested plots cannot be compared to previous years that only included 40% to 75% stocked plots.

WMU	*n*	% plots with adequate regeneration	Forest health assessment
1A	34	53	Fair
1B	28	45	Fair
2A	35	37	Poor
2B	n/a[a]	n/a[a]	---
2C	71	51	Fair
2D	53	43	Fair
2E	27	44	Fair
2F	64	47	Fair
2G	120	48	Fair
3A	28	56	Fair
3B	61	60	Fair
3C	42	49	Fair
3D	52	51	Fair
4A	29	55	Fair
4B	38	50	Fair
4C	34	48	Fair
4D	57	36	Poor
4E	21	60	Fair
5A	17	56	Fair
5B	22	35	Poor
5C	n/a[a]	n/a[a]	---
5D	n/a[a]	n/a[a]	--

[a] Regeneration data from these highly developed WMUs were not analyzed or considered in making deer management recommendations.

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, 2010-11.

	Antlered			Antlerless		
WMU	**Deer checked**	**Report cards**	**Harvest[1]**	**Deer checked**	**Report cards**	**Harvest[a]**
1A	271	2,001	5,900	870	3,865	11,900
1B	494	1,712	5,500	1,472	2,657	9,200
2A	254	2,034	5,800	908	3,613	13,500
2B	100	1,653	4,000	455	3,451	13,000
2C	579	3,043	8,500	728	3,442	9,600
2D	620	3,660	11,500	1,095	5,367	18,000
2E	288	1,575	4,200	332	1,733	6,000
2F	613	2,137	6,400	770	2,039	5,700
2G	523	3,076	6,800	169	1,534	3,600
3A	322	1,335	3,800	606	2,067	6,500
3B	524	2,065	5,400	870	2,664	7,600
3C	609	2,606	6,200	463	2,936	8,300
3D	328	1,593	3,900	524	2,140	5,500
4A	289	1,465	3,800	528	2,141	6,400
4B	389	1,897	4,500	478	1,814	5,100
4C	382	2,316	5,700	854	3,000	8,400
4D	463	2,547	6,300	420	1,793	5,500
4E	471	1,939	4,800	602	2,072	5,900
5A	90	1,073	2,400	191	1,486	3,400
5B	414	2,960	6,900	1,233	5,031	12,500
5C	404	3,388	9,400	1,392	8,382	24,000
5D	34	555	1,100	185	1,720	3,700
Unk.		50	130		3	10

[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 2010-11. 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
2009-10	8,443	49	51	55,200
2010-11	9,032	48	52	64,400

Table 6. Number of antlerless deer aged and age composition of harvests in Pennsylvania, 1997-98 to 2009-10. 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
2009-10	20,123	22	18	60
2010-11	14,837	23	18	59

Table 7. PASAK model estimates of deer populations by WMU, 2005 to 2010, Pennsylvania

WMU	2005	2006	2007	2008	2009	2010	Trend
1A	81,482	94,131	63,864	68,861	73,798	68,974	Stable
1B	84,078	94,054	82,345	97,872	71,504	76,665	Stable
2A	96,069	99,017	75,950	78,309	72,970	68,028	Decrease
2B	[a]	[a]	[a]	[a]	[a]	[a]	Stable
2C	125,302	145,410	150,246	133,998	104,698	107,368	Stable
2D	104,586	131,469	100,893	108,301	101,455	102,866	Stable
2E	56,949	62,108	41,687	53,341	43,859	44,783	Stable
2F	77,660	101,797	69,408	89,561	64,850	89,584	Stable
2G	64,457	111,534	67,202	97,026	58,654	71,897	Stable
3A	45,168	51,146	42,718	37,198	37,457	45,651	Stable
3B	66,885	69,898	69,521	50,662	55,176	50,245	Stable
3C	71,046	98,926	72,001	74,241	75,752	74,304	Stable
3D	48,296	59,047	45,760	45,621	30,792	32,466	Decrease
4A	36,154	54,823	54,800	33,760	31,318	34,778	Stable
4B	37,405	56,145	38,084	44,472	49,650	39,135	Stable
4C	50,238	55,880	43,968	42,515	39,095	46,636	Stable
4D	55,385	69,902	49,169	59,655	43,982	59,995	Stable
4E	72,971	61,983	55,555	56,175	52,840	65,894	Stable
5A	30,340	26,555	31,290	29,274	29,739	29,825	Stable
5B	126,342	135,600	115,452	122,279	101,060	102,587	Stable
5C	[a]	[a]	[a]	[a]	[a]	[a]	Stable
5D	[a]	[a]	[a]	[a]	[a]	[a]	Stable

[a] PASAK model estimates are not available for these WMUs. See Rosenberry et al. 2011 for further information. Population trend assessment in these WMUs is based on antlered harvests and antlerless catch per unit effort estimates.

Table 8. Antlerless license allocations by WMU, 2005-06 to 2011-12, Pennsylvania.

WMU	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
1A	40,000	42,000	42,000	42,000	42,000	41,705	42,000
1B	27,000	30,000	30,000	30,000	30,000	27,844	30,000
2A	55,000	55,000	60,000	55,000	55,000	54,879	65,000
2B	68,000	68,000	68,000	68,000	68,000	68,000	71,000
2C	53,000	49,000	49,000	49,000	49,000	44,107	58,000
2D	56,000	56,000	56,000	56,000	56,000	50,123	60,000
2E	21,000	21,000	21,000	21,000	21,000	20,407	25,000
2F	30,000	28,000	28,000	28,000	28,000	22,148	34,000
2G	29,000	19,000	26,000	26,000	26,000	15,210	23,000
3A	27,000	29,000	29,000	26,000	26,000	25,247	26,000
3B	41,000	43,000	43,000	43,000	43,000	33,761	40,000
3C	32,000	27,000	27,000	27,000	27,000	26,358	29,000
3D	38,000	38,000	38,000	37,000	37,000	31,622	39,000
4A	35,000	29,000	29,000	29,000	29,000	27,521	28,000
4B	35,000	31,000	23,000	23,000	23,000	22,148	23,000
4C	39,000	39,000	39,000	35,000	35,000	34,351	35,000
4D	40,000	40,000	40,000	40,000	40,000	30,052	37,000
4E	38,000	38,000	38,000	30,000	30,000	26,899	29,000
5A	28,000	25,000	22,000	19,000	19,000	18,269	19,000
5B	56,000	53,000	53,000	51,000	51,000	50,812	50,000
5C	71,000	79,000	84,000	92,000	113,000	121,960	117,000
5D	20,000	20,000	20,000	22,000	22,000	22,000	22,000