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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

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ABSTRACT We monitored Wildlife Management Unit (WMU) deer health, forest habitat health, and deer population trends using proportion of fawns in the antlerless harvest, advanced tree seedling and sapling regeneration and deer impact from the Pennsylvania Regeneration Study, deer harvest estimates and compositions, and field studies. Proportion of juveniles in the antlerless harvest remained stable in 21 of 23 WMUs from 2011 to 2016. Forest habitat health was judged to be good in 4 WMUs, and fair in 16 WMUs. Deer impacts were determined to be acceptable in 16 WMUs and too high in 4 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 333,254 deer (149,460 antlered and 183,794 antlerless) during the 2016-17 deer seasons. Deer populations in 18 WMUs remained stable, and 5 WMUs increased. No WMUs showed a decreasing population trend. The Board of Commissioners approved allocations as recommended in 8 WMUs, lower than recommended in 13 WMUs, and higher than recommended in 2 WMUs.

OBJECTIVE

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

METHODS

Deer Health

To monitor deer health (i.e., population productivity defined as proportion of fawns in the antlerless harvest), 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 Flowfinity software using Apple iPad Minis, and transmitted wirelessly to Flowfinity for analysis. 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 and when antlers were physically present, presence or absence of a brow tine on each antler to determine antler characteristics by age class.

We assessed population productivity by monitoring trends in proportion of juveniles in the antlerless harvest (Rosenberry et al. 2011b). 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 (PRS). This study is being conducted as part of the U.S. Forest Service (USFS) Forest Inventory Analysis in collaboration with Pennsylvania Department of Conservation and Natural Resources (DCNR) and Pennsylvania State University. Subsets of all plots are collected each year, with a complete sampling of plots occurring every 5 years. Advanced tree seedling and sapling regeneration from 2 groupings of tree species are available from the PRS. 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 et al. 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 Wildlife Management Institute (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 PRS, it takes 5 years to visit all sample plots.

Based on input from cooperating agencies that designed and conduct the PRS 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%.

In addition to forest health, we also assessed deer impact on the forest. These data were collected as part of the PRS. Deer impact was assessed on a scale from 1 (very low) to 5 (very high). We identified a score of 3 (moderate) as acceptable deer impact. Similar to the deer and forest health measures, the deer impact measure is based on a sample of plots from across a WMU and we use a statistical test to assess deer impact levels. By using a statistical test to assess differences from predetermined levels (e.g., 3), 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 a score of 3 using a t-test. The t-test determines whether the estimate is different from 3 based on standard statistical procedures. Since reliability of statistical tests is related to sample sizes, deer impact determinations are made based on 5-year data sets to maximize sample size and reliability of statistical tests.

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 Flowfinity software using Apple iPad Minis, and transmitted wirelessly to Flowfinity for analysis.. 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 and when antlers were physically present, presence or absence of a brow tine on each antler to determine antler characteristics by age class.

Data entry for deer harvest report card data was completed by Pennsylvania Game Commission Staff. The Pennsylvania Game Commission's Bureau of Automated Technology Services 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, online, or via phone reporting system 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. 2011a). 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. 2011a). We also used additional data and further modified the procedure for estimating antlered harvest rates based on age structure of the antlered harvest. This method provided similar population estimates and the benefit of estimates based on annual data rather than multi-year averages used by Norton (2010).

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

Age data from nearly 15,000 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 0.24 in WMU 2H to a high of 0.44 in WMU 5C, respectively (Table 1). All WMUs, except 2D and 2F, exhibited stable trends from 2011 to 2016.

Forest Habitat Health

Wildlife Management Unit forest habitat health assessments were based on the 5 years of the Pennsylvania Regeneration Study from 2011 to 2015. We identified 4 WMUs (WMUs 2C, 2F, 3A, and 4A) with good forest habitat health, and 16 with fair forest habitat health (Table 2). 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 some previous years' reports. In reports from 2006 to 2010, only plots with 40 to 75% stocking levels were analyzed. In this year's report, all plots were analyzed. Deer impact was acceptable in 16 WMUs and too high in 4 WMUs (Table 2).

Deer Harvest Estimates and Composition

Game Commission personnel checked an average of 399 (range: 73 to 690) antlered deer and 644 (range: 50 to 1,464) antlerless deer per WMU during the 2016 firearms season (Table 3). Based on deer checked and harvest reports by successful hunters, hunters harvested an estimated 333,254 deer in the 2016-17 deer seasons (Table 4). The antlered harvest was 149,460, up 9%

compared to the 2015-16 harvest of 137,580. The antlerless harvest was 183,794, up 3% from the harvest of 178,233 in 2015-16.

Antlerless harvests include deer taken with Chronic Wasting Disease Management Area permits (DMA permits). These permits allow hunters to take additional antlerless deer in DMA2 in southcentral and southwestern Pennsylvania. In addition, hunters are allowed to harvest antlerless deer throughout the 12-day firearms season. In 2016-17, 14,500 permits were available and 4,124 antlerless deer were reported to have been harvested. Disease Management Area permits increased antlerless deer harvests in 4 WMUs (Table 4). All permits are required to be reported, regardless of harvest, and 13,388 (92% of sold permits) were reported (Table 5). All DMA permit holders were sent post cards in mid-January reminding them to report their harvest or lack of harvest by the early February deadline.

Antlered harvests were composed of 44% 1.5-year-old males and 56% 2.5-year-old and older males (Table 6). 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 6). Antlerless harvest composition has changed little since 1997-98 hunting seasons (Table 7).

Deer Population Trends

Based on PASAK, deer population trends were stable in 18 WMUs, and increasing in 5 WMUs (Table 8). No WMUs had a decreasing trend.

Deer Management Recommendations

We continue to recommend consistent regulations that provide more hunting opportunities and use antlerless allocations to adjust antlerless harvests and population trends. Additional regulations we recommended included 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 1; and field possession regulations that allow a hunter to harvest another deer after tagging the first deer harvested. For antlerless allocations, we provided, as requested, allocation options that would increase, decrease, or stabilize WMU deer populations. Increases and decreases in the population would be achieved by a decrease or increase of 1 deer per square mile in the antlerless harvest. 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), deer impact, and deer-human conflicts from a survey of Pennsylvania citizens (Duda et al. 2012). We recommended population stabilization in most all WMUs except WMUs 2G, 3D, and 4B. Wildlife Management Units 2G, 3D, and 4B have deer impacts that are too high (Table 2). As a result, we recommended population reductions. Wildlife Management Unit 3C also has high deer impacts, but we recommended an allocation to stop the ongoing deer population increase for 2017-18 hunting seasons. In WMUs with chronic wasting disease (CWD)-positive wild deer, we recommended stabilizing deer populations with the antlerless allocation, but providing additional Deer Management Assistance Program (DMAP) antlerless permits to reduce the deer population in areas where CWD-positive deer have been detected.

Action by the Board of Commissioners

The Board of Commissioners retained the 5-day antlered and 7-day concurrent firearms season in WMUs 1A, 1B, 2A, 2C, 2D, 2E, 2F, 2G, 2H, 3A, 3B, 3C, 3D, 4A, 4B, 4C, 4D, and 4E and added the split season to WMUs 5A and 5B. The Board of Commissioners decided to reduce recommended antlerless allocations in 13 WMUs and increased the allocation in 2 WMUs (2H and 5D). Recommended allocations were approved in 8 WMUs. Allocations below recommended levels will allow populations to increase.

RECOMMENDATIONS

1. 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.

2. 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.

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

4. Return to 12-day concurrent antlered and antlerless firearms seasons for all WMUs. Deer hunter surveys indicate Pennsylvania's future hunters and their mentors prefer the 12 day concurrent season. Time to hunt was the top reason for increased hunter interest for all ages. 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.

5. Continue antler restriction regulations in accordance with goals and objectives of the 2009-2018 deer management plan.

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

7. In WMUs containing CWD-positive deer in the free-ranging population, allocate antlerless licenses to stabilize the deer population and use DMAP permits to reduce deer numbers in areas where CWD-positive deer have been detected.

8. Set antlerless license allocations to achieve deer management goals as defined in the deer management plan.

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Table 1. Number of antlerless deer examined in 2016, proportion of juveniles in the antlerless 2016 harvest, and trend in the proportion of juveniles in the antlerless harvest by Wildlife Management Unit (WMU) from 2011 to 2016, Pennsylvania.

WMU	*n*	Proportion of juveniles in antlerless harvest	Trend
1A	650	0.43	Stable
1B	1,147	0.37	Stable
2A	624	0.36	Stable
2B	590	0.41	Stable
2C	861	0.35	Stable
2D	1,444	0.36	Decline
2E	446	0.36	Decline
2F	636	0.33	Stable
2G	264	0.31	Stable
2H	49	0.24	Stable
3A	248	0.27	Stable
3B	746	0.37	Stable
3C	900	0.38	Stable
3D	343	0.31	Stable
4A	534	0.29	Stable
4B	584	0.35	Stable
4C	638	0.36	Stable
4D	778	0.31	Stable
4E	796	0.35	Stable
5A	257	0.33	Stable
5B	1,189	0.37	Stable
5C	901	0.44	Stable
5D	341	0.42	Stable

Table 2. Number of regeneration plots sampled, percent with adequate regeneration, mean deer impact and qualitative assessments of regeneration and deer impact by Wildlife Management Unit (WMU). Data are based on samples collected from 2011 to 2015, Pennsylvania. Results are based on all forested plots and cannot be compared to some previous years that only included 40% to 75% stocked plots.

WMU	*n*	% plots with adequate regeneration	Forest health assessment	Mean deer impact	Impact assessment
1A	24	54%	Fair	2.9	Acceptable
1B	23	53%	Fair	3.1	Acceptable
2A	29	43%	Fair	3.0	Acceptable
2B	n/a[a]	n/a[a]	n/a[a]	n/a[a]	n/a[a]
2C	50	62%	Good	2.9	Acceptable
2D	40	44%	Fair	2.9	Acceptable
2E	17	63%	Fair	3.0	Acceptable
2F	35	61%	Good	2.9	Acceptable
2G	59	56%	Fair	3.1	Too high
2H	21	57%	Fair	2.7	Acceptable
3A	25	67%	Good	3.0	Acceptable
3B	42	61%	Fair	3.2	Acceptable
3C	31	53%	Fair	3.4	Too high
3D	39	57%	Fair	3.3	Too high
4A	30	63%	Good	2.6	Acceptable
4B	28	63%	Fair	3.5	Too high
4C	29	60%	Fair	3.1	Acceptable
4D	49	52%	Fair	3.1	Acceptable
4E	15	56%	Fair	3.2	Acceptable
5A	8	58%	Fair	3.3	Acceptable
5B	18	55%	Fair	3.1	Acceptable
5C	n/a[a]	n/a[a]	n/a[a]	n/a[a]	n/a[a]
5D	n/a[a]	n/a[a]	n/a[a]	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 3. Number of deer checked by Pennsylvania Game Commission personnel, number of report cards sent in by successful hunters, and estimated harvests for antlered and antlerless deer by Wildlife Management Unit (WMU), Pennsylvania, 2016-17. These results do not include antlerless harvests from Disease Management Area (DMA) permits (See Table 4).

	Antlered			Antlerless		
WMU	**Deer checked**	**Report cards**	**Harvest[a]**	**Deer checked**	**Report cards**	**Harvest[a]**
1A	274	2,221	6,500	645	3,228	10,400
1B	585	2,210	7,900	1,164	2,221	8,200
2A	290	1,931	7,000	640	2,463	9,200
2B	94	1,770	5,800	598	2,939	14,000
2C	535	3,468	8,300	762	2,286	6,900
2D	625	4,041	12,800	1,464	4,894	16,400
2E	331	1,855	5,200	443	1,632	5,200
2F	659	2,838	7,700	647	1,772	6,700
2G	394	2,464	6,200	271	1,483	4,000
2H	73	832	1,900	50	510	1,900
3A	287	1,678	5,400	255	1,194	3,800
3B	617	2,481	7,500	751	2,200	7,300
3C	690	2,959	8,600	901	3,404	11,000
3D	376	1,733	4,300	352	1,343	4,200
4A	297	1,810	4,400	384	1,680	5,700
4B	365	2,003	5,200	580	1,852	6,200
4C	515	2,621	6,400	653	1,878	5,300
4D	630	2,849	7,900	728	2,351	7,200
4E	633	2,772	7,300	804	2,367	7,500
5A	122	1,324	3,000	265	1,597	4,000
5B	398	3,095	8,900	1,194	4,345	12,400
5C	299	3,053	8,300	918	5,208	15,600
5D	78	1,214	2,900	350	2,683	6,500
Unk.		23	60		24	70

[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 4. Reported Disease Management Area (DMA) permit antlerless deer harvest by Wildlife Management Unit (WMU), Pennsylvania 2014-15 to 2016-17.

WMU	2014-15	2015-16	2016-17
1A	0	0	0
1B	0	0	0
2A	0	0	0
2B	0	0	0
2C	429	1,190	1,435
2D	0	0	0
2E	0	0	141
2F	0	0	0
2G	0	0	0
2H	0	0	0
3A	0	0	0
3B	0	0	0
3C	0	0	0
3D	0	0	0
4A	1,805	2,270	2,213
4B	0	0	0
4C	0	0	0
4D	248	243	333
4E	0	0	0
5A	0	0	0
5B	0	0	0
5C	0	0	0
5D	0	0	0

Table 5. Number of Disease Management Area (DMA) permits allocated, sold, reported, reporting rate, antlerless deer harvested, and licenses sold per antlerless deer harvested in Pennsylvania, 2014-15 to 2016-17.

Year	Permits Allocated	Permits Sold	Permits Reported	Reporting Rate	Reported Harvest	Licenses per Harvest
2014-15	13,000	12,170	10,734	0.88	2,482	4.9
2015-16	13,500	13,521	12,562	0.93	3,703	3.7
2016-17	14,500	14,542	13,388	0.92	4,124	3.5

Table 6. 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 2016-17. Three and 4-point antler restrictions started in 2002-03. In 2011, the 4-point antler restriction was modified to 3-points not including the brow tine. 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	11,694	68	32	52,900
2003-04	11,367	56	44	62,600
2004-05	10,559	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
2011-12	10,311	50	50	63,770
2012-13	10,588	48	52	69,000
2013-14	9,937	47	53	71,200
2014-15	9,225	43	57	67,978
2015-16	9,762	41	59	81,172
2016-17	9,792	44	56	83,403

Table 7. Number of antlerless deer aged and age composition of harvests in Pennsylvania, 1997-98 to 2016-17. 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	16,519	22	18	60
2010-11	14,837	23	18	59
2011-12	16,050	21	19	60
2012-13	15,563	22	18	61
2013-14	15,924	21	18	62
2014-15	14,909	20	18	61
2015-16	14,551	20	17	63
2016-17	14,966	20	16	64

Table 8. Pennsylvania Sex-Age-Kill (PASAK) model estimates of post-hunt deer populations by Wildlife Management Unit (WMU), 2009 to 2017, Pennsylvania.

WMU	2009	2010	2011	2012	2013	2014	2015	2016	2017	Trend
1A	36,152	44,148	41,549	42,420	48,472	55,114	49,169	62,237	65,707	Increasing
1B	58,926	44,469	46,503	51,697	55,713	53,799	47,438	71,669	74,053	Stable
2A	50,336	56,286	49,033	68,080	53,996	43,379	30,033	48,723	57,963	Stable
2B	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	Stable
2C	72,402	62,340	66,729	64,888	61,386	68,683	66,027	83,350	69,034	Stable
2D	88,666	86,493	101,182	102,440	113,774	144,084	110,214	117,823	112,499	Stable
2E	42,709	38,317	38,134	30,384	44,546	45,529	50,549	43,081	43,144	Stable
2F	67,724	46,887	70,765	53,210	83,063	65,614	61,020	67,152	74,387	Stable
2G[b]		41,125	44,582	58,441	60,019	49,313	40,343	65,521	67,942	Stable
2H[b]		12,338	15,410	12,554	13,356	16,537	16,872	15,430	15,704	Stable
3A	32,513	31,412	39,532	31,224	41,358	45,317	36,181	49,307	49,426	Increasing
3B	46,869	48,895	49,768	58,481	53,709	63,803	55,249	76,808	80,598	Stable
3C	54,141	65,624	59,245	64,359	67,720	58,925	67,997	83,206	85,083	Increasing
3D	37,563	25,378	30,250	31,299	29,225	25,127	33,778	28,957	33,302	Stable
4A	34,628	30,789	38,125	49,191	36,579	42,196	23,772	48,538	29,746	Stable
4B	39,044	43,550	37,273	60,340	52,903	50,517	45,362	57,846	55,941	Stable
4C	45,224	44,256	58,091	45,093	45,586	49,072	50,265	55,068	55,311	Increasing
4D	62,529	46,284	73,017	70,495	67,011	61,428	56,905	60,398	63,984	Stable
4E	37,339	36,311	51,706	44,225	48,318	50,707	59,206	64,923	62,285	Increasing
5A	20,504	20,512	21,098	35,598	28,014	29,715	25,032	20,081	28,581	Stable
5B	59,568	53,213	55,951	60,723	75,260	63,591	60,538	66,282	73,573	Stable
5C	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	Stable
5D	[a]	[a]	[a]	[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.

[b] WMUs 2G and 2H were created in 2013 by dividing WMU 2G.

Table 9. Antlerless license allocations by Wildlife Management Unit (WMU), 2005-06 to 2017-18, Pennsylvania.

WMU	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
1A	42,000	42,000	42,000	42,000	41,705	42,000	42,000	49,000	47,000	46,000	46,000	52,000
1B	30,000	30,000	30,000	30,000	27,844	30,000	33,000	31,000	30,000	29,000	29,000	35,000
2A	55,000	60,000	55,000	55,000	54,879	65,000	59,000	49,000	46,000	43,000	43,000	50,000
2B	68,000	68,000	68,000	68,000	68,000	71,000	67,000	62,000	60,000	61,000	61,000	60,000
2C	49,000	49,000	49,000	49,000	44,107	58,000	50,000	43,000	38,000	31,000	31,000	31,000
2D	56,000	56,000	56,000	56,000	50,123	60,000	62,000	61,000	61,000	55,000	55,000	55,000
2E	21,000	21,000	21,000	21,000	20,407	25,000	21,000	22,000	21,000	21,000	21,000	22,000
2F	28,000	28,000	28,000	28,000	22,148	34,000	27,000	29,000	27,000	22,000	22,000	24,000
2G[a]	19,000	26,000	26,000	26,000	15,210	23,000	33,000	28,000	22,000	22,000	21,000	25,500
2H[a]								6,000	5,500	6,500	6,000	7,000
3A	29,000	29,000	26,000	26,000	25,247	26,000	26,000	23,000	18,000	19,000	15,000	20,000
3B	43,000	43,000	43,000	43,000	33,761	40,000	40,000	39,000	33,000	28,000	28,000	30,000
3C	27,000	27,000	27,000	27,000	26,358	29,000	35,000	35,000	32,000	36,000	36,000	42,000
3D	38,000	38,000	37,000	37,000	31,622	39,000	39,000	32,000	25,000	25,000	25,000	25,000
4A	29,000	29,000	29,000	29,000	27,521	28,000	29,000	28,000	28,000	30,000	30,000	30,000
4B	31,000	23,000	23,000	23,000	22,148	23,000	26,000	24,000	26,000	26,000	26,000	26,000
4C	39,000	39,000	35,000	35,000	34,351	35,000	35,000	27,000	25,000	25,000	25,000	29,000
4D	40,000	40,000	40,000	40,000	30,052	37,000	36,000	35,000	33,000	33,000	34,000	34,000
4E	38,000	38,000	30,000	30,000	26,899	29,000	28,000	26,000	21,000	25,000	25,000	27,500
5A	25,000	22,000	19,000	19,000	18,269	19,000	19,000	19,000	19,000	19,000	19,000	22,000
5B	53,000	53,000	51,000	51,000	50,812	50,000	51,000	50,000	49,000	50,000	50,000	57,000
5C	79,000	84,000	92,000	113,000	121,960	117,000	111,000	103,000	95,000	70,000	70,000	70,000
5D	20,000	20,000	22,000	22,000	22,000	22,000	19,000	18,000	18,000	24,000	30,000	30,000

[a] WMUs 2G and 2H were created in 2013 by dividing WMU 2G.