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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

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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 has remained stable in all WMUs since 2003. Forest habitat health was judged to be good in 2 WMUs, and fair in 18 WMUs. Deer impacts were determined to be acceptable in 18 WMUs and too high in 2 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 343,110 deer (133,860 antlered and 209,250 antlerless) in the 2012-13 deer seasons. Deer populations in 18 WMUs remained stable, while 4 WMUs increased and 1WMU decreased. The Board of Commissioners set antlerless allocations to stabilize deer populations in 13 WMUs and increase deer populations in 10 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 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 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 (FIA) in collaboration with Pennsylvania Department of Conservation and Natural Resources (DCNR) and Pennsylvania State University (PSU). 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 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 and when antlers were physically present, presence or absence of a brow tine on each antler to determine antler characteristics by age class.

A data entry company was contracted to enter deer harvest report card data. The Pennsylvania Game Commission's (PGC'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). This year, we took advantage of 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).

For WMUs 2D, 2G, 3C, and 4B, we used the current version of the PASAK model instead of the integrated population models (IPMs) that were used last year (Rosenberry et al. 2012b). We used the PASAK model because the project that created the IPMs was completed last year and updated IPM estimates were not available.

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 more than 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 0.29 in WMU 2G to a high of 0.49 in WMU 5C (Table 1). 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 2008 to 2012. We identified 2 WMUs (WMUs 3B and 5A) with good forest habitat health, and 18 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 18 WMUs and too high in 2 WMUs (Table 2).

Deer Harvest Estimates and Composition

PGC personnel checked an average of 453 (range: 45 to 742) antlered deer and 773 (range: 160 to 1,911) antlerless deer per WMU during the 2012 firearms season (Table 3). Based on deer checked and harvest reports by successful hunters, hunters harvested an estimated 343,110 deer in the 2012-13 deer seasons (Table 4). The antlered harvest was 133,860, an increase of 5% from the 2011-12 harvest of 127,540. The antlerless harvest was 209,250, similar to the harvest of 208,660 in 2011-12.

Antlered harvests were composed of 48% 1.5-year-old males and 52% 2.5-year-old and older males (Table 4). 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 4). Antlerless harvest composition has changed little since 1997-98 hunting seasons (Table 5).

Deer Population Trends

Based on PASAK, deer population trends were stable in 18 WMUs, increasing in 4 WMUs, and decreasing in 1 WMU (Table 6).

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. Research in the 4 WMUs (2D, 2G, 3C, and 4B) with a 7-day concurrent season showed that the 7-day season failed to achieve nearly all of its objectives. In addition, surveys of hunters show that 'time to hunt' was the top reason for increasing deer hunter interest in all age classes (Rosenberry et al. 2012a). Although hunters were split on their preference for a 7-day or 12-day antlerless season, hunters less than 45 years of age preferred a 12 day antlerless season. These same hunters also indicated that they hunt to harvest any deer. Hunters less than 45 years of age represent the future of Pennsylvania deer hunting as hunters and mentors of new hunters. The 12-day concurrent season provides more time for harvesting antlerless deer, and is compatible with sustainable deer populations. Consistent regulations reduce uncertainty when interpreting changes in harvests and population parameters. Based on input from hunters and field data to indicate no advantages of the 7-day concurrent season, we recommended a statewide, 12-day concurrent antlered and antlerless season. 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 the deer population with either a 5-day antlered and 7-day concurrent firearms season or a 12-day concurrent firearm season. 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). Based on these data, no WMU has achieved its deer management goals to warrant a population increase. As a result, we recommended population stabilization in all WMUs except WMUs 4A, 5A, and 5B. In these WMUs that contain substantial portions of Chronic Wasting Disease (CWD) disease management areas, we recommended an increase in the antlerless harvest of 1 deer per square mile to increase sample sizes for disease testing and to help reduce the spread of CWD to other areas.

Action by the Board of Commissioners

The Board of Commissioners retained the 5-day antlered/7-day concurrent firearms season in 11 WMUs (2A, 2C, 2D, 2E, 2F, 2G, 3B, 3C, 4B, 4D, and 4E). The Board of Commissioners decided to reduce recommended antlerless allocations in 13 WMUs. In 10 WMUs, this decision will allow populations to increase or continue to increase (WMUs 2A, 2C, 2D, 2G, 3A, 3C, 3D, 4C, 4E, and 5C). The Board of Commissioners decided against increasing antlerless harvests in WMUs with a CWD disease management area (WMUs 4A, 5A, and 5B). The approved antlerless allocations increased allocations from 2012-13 to 2013-14 season in 3 WMUs, remained the same in 2 WMUs, and decreased in 16 WMUs (Table 7). This was the first season for the new WMU 2G and WMU 2H.

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 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. Monitor changes to antler restrictions in WMUs 1A, 1B, 2A, 2B, and 2D using harvest age structure data and antler characteristics.

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

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

LITERATURE CITED

Chapman, D. G. 1951. Some properties of the hypergeometric distribution with applications to zoological censuses. University of California Publications on Statistics 1:131-160.

Duda, M.D., M. Jones, T. Beppler, SlJ. Bissell, A. Criscione, P. Doherty, A. Ritchie, C.L. Schilli, T. Winegord, and A. Lanier. 2012. Pennsylvania residents' opinions on and attitudes toward deer and deer management. Responsive Management National Office, Harrisonburg, Virginia, USA.

Keenan, M. T. 2010. White-tailed deer harvest rate and hunter distribution. Thesis, The Pennsylvania State University, University Park, USA.

Kendall, M. G., and J. D. Gibbons. 1990. Rank Correlation Methods. Fifth edition. Edward Arnold, London, United Kingdom.

Long, E. S., D. R. Diefenbach, C. S. Rosenberry, B. D. Wallingford, and M. D. Grund. 2005. Landscape structure influences dispersal distances of a habitat generalist, the white-tailed deer. Journal of Mammalogy 86:623-629.

Mann, H. B. 1945. Non-parametric tests against trend. Econometrica 13:245-259.

Marquis, D. A., R. L. Ernst, and S. L. Stout. 1992. Prescribing silvicultural treatments in hardwood stands of the Alleghenies. Revised editor. U.S. Forest Service General Technical Report NE-96.

Marquis, D. A., editor. 1994. Quantitative silviculture for hardwood forests of the Alleghenies. General Technical Report. NE-183. U.S. Department of Agriculture Forest Service, Northeastern Research Station, Radnor, Pennsylvania, USA.

McWilliams, W. H., C. A. Alerich, D. A. Devlin, A. J. Lister, T. W. Lister, S. L. Sterner, and J. A. Westfall. 2004. Annual inventory report for Pennsylvania's forests: results from the first three years. Resource Bulletin NE-159. USDA Forest Service, Newtown Square, Pennsylvania, USA.

Nichols, J. D. and C. R. Dickman. 1996. Capture-recapture methods in measuring and monitoring biological diversity: standard methods for mammals. Pages 217-226 *in* D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, editors. Smithsonian Institute Press, Washington D.C., USA.

Norton, A. S. 2010. An evaluation of the Pennsylvania sex-age-kill model for white-tailed deer. Thesis, The Pennsylvania State University, University Park, USA.

Rosenberry, C. S., D. R. Diefenbach, and B. D. Wallingford. 2004. Reporting rate variability and precision of white-tailed deer harvest estimates in Pennsylvania. Journal of Wildlife Management 68:860-869.

Rosenberry, C. S., J. T. Fleegle, and B. D. Wallingford. 2011a. Monitoring deer populations in Pennsylvania. Pennsylvania Game Commission, Harrisburg, USA.

Rosenberry, C. S., A. S. Norton, D. R. Diefenbach, J. T. Fleegle, and B. D. Wallingford. 2011b. White-tailed deer age ratios as herd management and predator impact measures in Pennsylvania. Wildlife Society Bulletin 35:461-468.

Rosenberry, C. S., B. D. Wallingford, and J. T. Fleegle. 2012a. Deer Hunter Surveys. Pennsylvania Game Commission, Harrisburg, USA.

Rosenberry, C. S., B. D. Wallingford, J. T. Fleegle, F. R. Buderman, and D. R. Diefenbach. 2012b. Biological and social implications of a 7-day concurrent firearms season in Pennsylvania. Pennsylvania Game Commission, Harrisburg, USA.

Severinghaus, C. W. 1949. Tooth development and wear as criteria of age in white-tailed deer. Journal of Wildlife Management 13:195-216.

Wildlife Management Institute. 2010. The deer management program of the Pennsylvania Game Commission: a comprehensive review and evaluation. The Wildlife Management Institute, Washington D.C., USA. <http://lbfc.legis.state.pa.us/reports/2010/43.PDF> Accessed 22 Oct 2010.

Table 1. Number of antlerless deer examined, proportion of juveniles in the antlerless harvest, and trend in the proportion of juveniles in the antlerless harvest by Wildlife Management Unit (WMU) from 2003 to 2012, Pennsylvania.

WMU	*n*	Proportion of juveniles in antlerless harvest	Trend
1A	856	0.48	Stable
1B	1,876	0.37	Stable
2A	775	0.38	Stable
2B	441	0.45	Stable
2C	876	0.38	Stable
2D	1,274	0.42	Stable
2E	383	0.43	Stable
2F	497	0.39	Stable
2G[a]	313	0.29	Stable
2H[a]	73	0.36	Stable
3A	687	0.34	Stable
3B	600	0.39	Stable
3C	812	0.32	Stable
3D	613	0.34	Stable
4A	539	0.32	Stable
4B	412	0.33	Stable
4C	816	0.39	Stable
4D	421	0.37	Stable
4E	599	0.45	Stable
5A	226	0.35	Stable
5B	1,093	0.42	Stable
5C	1,220	0.49	Stable
5D	158	0.44	Stable

[a] WMUs 2G and 2H were created in 2013 by dividing WMU 2G. Data were partitioned based on townships for the 2013-14 seasons and bag limit recommendations.

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 2008 to 2012, 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	31	53	Fair	2.9	Acceptable
1B	23	60	Fair	3.0	Acceptable
2A	33	42	Fair	2.8	Acceptable
2B	n/a[a]	n/a[a]	n/a[a]	n/a[a]	n/a[a]
2C	69	56	Fair	2.8	Acceptable
2D	46	46	Fair	2.9	Acceptable
2E	26	52	Fair	2.4	Acceptable
2F	51	54	Fair	2.9	Acceptable
2G[b]	77	56	Fair	2.7	Acceptable
2H[b]	30	51	Fair	2.3	Acceptable
3A	25	60	Fair	3.0	Acceptable
3B	57	65	Good	3.0	Acceptable
3C	36	54	Fair	3.3	Too High
3D	50	59	Fair	3.4	Too High
4A	28	60	Fair	2.6	Acceptable
4B	37	61	Fair	3.2	Acceptable
4C	28	61	Fair	2.8	Acceptable
4D	53	48	Fair	2.8	Acceptable
4E	22	60	Fair	2.9	Acceptable
5A	15	66	Good	2.9	Acceptable
5B	17	52	Fair	2.9	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.

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

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, 2012-13.

	Antlered			Antlerless		
WMU	**Deer checked**	**Report cards**	**Harvest[1]**	**Deer checked**	**Report cards**	**Harvest[a]**
1A	343	1,996	6,100	858	3,492	11,900
1B	715	2,007	7,000	1,911	2,933	11,100
2A	321	2,054	6,700	789	2,779	12,700
2B	150	1,633	4,800	453	3,373	16,000
2C	591	2,875	7,600	882	3,235	10,800
2D	643	4,178	13,700	1,293	5,652	20,800
2E	356	1,715	4,800	384	1,646	5,600
2F	686	2,275	7,100	521	1,731	6,100
2G	613	2,886	6,600	411	2,165	6,500
3A	425	1,536	4,300	701	2,005	6,700
3B	525	2,088	5,800	608	2,128	8,700
3C	742	2,790	7,900	828	3,181	10,500
3D	454	1,606	4,000	642	2,168	6,000
4A	317	1,548	4,200	553	2,146	6,500
4B	461	1,983	5,600	419	1,878	5,600
4C	432	2,205	5,300	851	2,699	7,800
4D	563	2,589	6,900	425	2,063	6,300
4E	511	2,150	5,000	602	2,086	6,100
5A	135	1,094	2,600	236	1,454	3,300
5B	438	2,840	8,100	1,123	4,145	11,900
5C	499	3,239	7,800	1,252	7,190	23,600
5D	45	518	1,300	160	1,473	3,800
Unk.		20	60		15	50

[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. 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 2012-13. 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	11,688	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
2011-12	9,747	50	50	63,770
2012-13	10,588	48	52	69,000

Table 5. 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
2011-12	16,249	21	19	60
2012-13	15,563	22	18	61

Table 6. PASAK model estimates of post-hunt deer populations by Wildlife Management Unit (WMU), 2006 to 2013, Pennsylvania.

WMU	2006	2007	2008	2009	2010	2011	2012	2013	Trend
1A	48,245	51,388	34,007	36,152	44,148	41,549	42,420	48,472	Increasing
1B	54,294	55,239	52,810	58,926	44,469	46,503	51,697	55,713	Stable
2A	59,371	65,971	45,462	50,336	56,286	49,033	68,080	53,996	Stable
2B	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	Stable
2C	71,140	82,966	87,046	72,402	62,340	66,729	64,888	61,386	Decreasing
2D	82,869	101,933	69,732	88,666	86,493	101,182	102,440	113,774	Increasing
2E	47,874	48,429	32,623	42,709	38,317	38,134	30,384	44,546	Stable
2F	60,159	74,328	47,288	67,724	46,887	70,765	53,210	83,063	Stable
2G[b]					41,125	44,582	58,441	60,019	Increasing
2H[b]					12,338	15,410	12,554	13,356	Stable
3A	37,729	39,782	32,425	32,513	31,412	39,532	31,224	41,358	Stable
3B	56,646	59,363	56,162	46,869	48,895	49,768	58,481	53,709	Stable
3C	44,118	63,175	45,511	54,141	65,624	59,245	64,359	67,720	Increasing
3D	38,553	43,496	31,623	37,563	25,378	30,250	31,299	29,225	Stable
4A	31,072	54,851	47,414	34,628	30,789	38,125	49,191	36,579	Stable
4B	29,506	47,404	30,479	39,044	43,550	37,273	60,340	52,903	Stable
4C	52,285	57,863	44,569	45,224	44,256	58,091	45,093	45,586	Stable
4D	57,425	72,047	43,299	62,529	46,284	73,017	70,495	67,011	Increasing
4E	48,771	34,660	35,121	37,339	36,311	51,706	44,225	48,318	Stable
5A	21,982	17,149	22,602	20,504	20,512	21,098	35,598	28,014	Stable
5B	63,740	62,404	54,020	59,568	53,213	55,951	60,723	75,260	Stable
5C	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	Stable
5D	[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. Data were partitioned based on townships for the 2013-14 seasons and bag limit recommendations.

Table 7. Antlerless license allocations by Wildlife Management Unit (WMU), 2005-06 to 2013-14, Pennsylvania.

WMU	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
1A	40,000	42,000	42,000	42,000	42,000	41,705	42,000	42,000	49,000
1B	27,000	30,000	30,000	30,000	30,000	27,844	30,000	33,000	31,000
2A	55,000	55,000	60,000	55,000	55,000	54,879	65,000	59,000	49,000
2B	68,000	68,000	68,000	68,000	68,000	68,000	71,000	67,000	62,000
2C	53,000	49,000	49,000	49,000	49,000	44,107	58,000	50,000	43,000
2D	56,000	56,000	56,000	56,000	56,000	50,123	60,000	62,000	61,000
2E	21,000	21,000	21,000	21,000	21,000	20,407	25,000	21,000	22,000
2F	30,000	28,000	28,000	28,000	28,000	22,148	34,000	27,000	29,000
2G[a]	29,000	19,000	26,000	26,000	26,000	15,210	23,000	33,000	28,000
2H[a]									6,000
3A	27,000	29,000	29,000	26,000	26,000	25,247	26,000	26,000	23,000
3B	41,000	43,000	43,000	43,000	43,000	33,761	40,000	40,000	39,000
3C	32,000	27,000	27,000	27,000	27,000	26,358	29,000	35,000	35,000
3D	38,000	38,000	38,000	37,000	37,000	31,622	39,000	39,000	32,000
4A	35,000	29,000	29,000	29,000	29,000	27,521	28,000	29,000	28,000
4B	35,000	31,000	23,000	23,000	23,000	22,148	23,000	26,000	24,000
4C	39,000	39,000	39,000	35,000	35,000	34,351	35,000	35,000	27,000
4D	40,000	40,000	40,000	40,000	40,000	30,052	37,000	36,000	35,000
4E	38,000	38,000	38,000	30,000	30,000	26,899	29,000	28,000	26,000
5A	28,000	25,000	22,000	19,000	19,000	18,269	19,000	19,000	19,000
5B	56,000	53,000	53,000	51,000	51,000	50,812	50,000	51,000	50,000
5C	71,000	79,000	84,000	92,000	113,000	121,960	117,000	111,000	103,000
5D	20,000	20,000	20,000	22,000	22,000	22,000	22,000	19,000	18,000

[a] WMUs 2G and 2H were created in 2013 by dividing WMU 2G. Data were partitioned based on townships for the 2013-14 seasons and bag limit recommendations.