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TITLE: White-tailed Deer Research/Management

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

PERIOD COVERED: 1 July 2020 through 30 June 2021

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 17 of 23 WMUs and was decreasing in 6 WMUs from 2015 to 2020. Forest habitat health was judged to be good in 4 WMUs, fair in 15 WMUs, and poor in 1 WMU. 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 an estimated 435,180 deer (174,780 antlered and 261,827 antlerless), during the 2020-21 deer seasons. Deer populations in 19 WMUs remained stable, and 3 WMUs increased while 1 decreased. The Board of Commissioners approved allocations as recommended in all WMUs for a 14-day concurrent firearms season.

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), 31 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 and deer impacts 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 - 7 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 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 obtained ATSSR data for dominant canopy species and species capable of achieving high canopy status by WMU from the USFS website (USDA 2020) 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. 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 5-7 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, 31 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 over 16,800 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 0.22 in WMU 2H to a high of 0.44 in WMU 5D (Table 1). Seventeen WMUs showed stable trends, while 6 had decreasing trends from 2015 to 2020.

Forest Habitat Health

Wildlife Management Unit forest habitat health assessments were based on the 5 years of the Pennsylvania Regeneration Study from 2015 to 2019. We identified 4 WMUs (WMUs 1A, 2F, 3B, and 4A) with good forest habitat health, and 15 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

Game Commission personnel checked an average of 288 (range: 59 to 573) antlered deer and 692 (range: 69 to 1,466) antlerless deer per WMU during the 2020 firearms season (Table 3). Based on deer checked and harvest reports by successful hunters, hunters harvested an estimated

436,607 deer in the 2020-21 deer seasons (Table 3 and Table 4). The antlered harvest was 174,780, up 7% compared to the 2019-20 harvest of 163,240. The antlerless harvest was 261,827, up 16% compared to the harvest of 226,191 in 2019-20.

The total antlerless harvest of 261,827 includes the WMU-based harvest of 260,400 antlerless deer (table 3) plus 1,427 antlerless deer taken with Deer Management Assistance Program (DMAP) permits in a Chronic Wasting Disease Management Area (Table 4 and Table 5). These permits allow hunters to take additional antlerless deer in designated land (public and private) within Disease Management Area (DMA)2, DMA3, and DMA4. In addition, hunters using DMAP permits were allowed to harvest antlerless deer throughout the 14-day firearms season. Deer Management Assistance Program permits within DMA2, DMA3, and DMA4 increased antlerless deer harvests in 10 WMUs (Table 4). All permits are required to be reported, regardless of harvest, and 6,361 (70% of sold permits) were reported (Table 5). All DMAP permit holders were sent post cards in mid-January reminding them to report their harvest or lack of harvest by the early February deadline. However, due to an error in the phone number option, another card was sent at the end of January, and reporting was extended until late February.

Antlered harvests were composed of 36% 1.5-year-old males and 64% 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 been slowly changing toward more adult females since the 1997-98 hunting seasons (Table 7).

Deer Population Trends

Based on PASAK, deer population trends were stable in 16 WMUs, and increasing in 3 WMUs (Table 8). One WMU had a decreasing trend. In WMUs 2B, 5C, and 5D, PASAK cannot be used, but population trends in these WMUs are stable based on antlered harvests and antlerless catch per unit effort estimates.

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; and the sale of all unsold antlerless licenses after all hunters have had an opportunity to purchase 1. For antlerless allocations, we were directed to provide allocations to move WMUs toward the deer plan population goals with a 14-day concurrent firearms season. In units that previously had a 7-day concurrent firearms season, we adjusted the allocation based on past 12-day concurrent season success rates in the WMU. Population reductions in WMUs that are part of a DMA would be achieved with increased antlerless harvest of 1-2 deer per square mile. Population reductions in WMUs that are not part of a DMA would be achieved by an increase of 1 deer per square mile in the antlerless harvest. To assist the Board of Commissioners (BOC) 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. 2019). We recommended population stabilization in 14 WMUs (1A, 1B, 2A, 2B, 2F, 2G, 2H, 3A, 3B, 3C, 4C, 5B, 5C, and 5D), and

reductions in 9 WMUs (2C, 2D, 2E, 3D, 4A, 4B, 4D, 4E, and 5A). In WMU 3D, the goal is to increase the antlerless harvest by 1 deer per square mile due to forest impacts. The remaining 8 WMUs are part of a DMA. With the exception of 5A, all units have CWD in free-ranging deer. In 2021-22, recommended allocations to address CWD were based mainly on the WMU level. But we also recommend providing additional DMAP antlerless permits where necessary to enhance surveillance.

Action by the Board of Commissioners (BOC)

The BOC voted to make season-long concurrent firearms season for antlered and antlerless deer season in all WMUs, and they adopted antlerless allocations for all WMUs (Table 9). Recommended allocations were approved in all units.

The BOC voted to keep the opening day of rifle deer season on the Saturday after Thanksgiving, and to allow deer hunting on the Sunday following opening day. The last Sunday of the archery season was again approved as a hunting day. The fall archery season extension was again approved, ending on the Friday before bear season. They also voted to allow the harvest of additional deer before tagging the first deer. The limit of DMAP permits per DMAP area was increased to 4, except in units that the Game Commission designates. The limit of 3 antlerless WMU-specific antlerless licenses was lifted. Hunters now may hold up to 6 unfilled, WMU-specific antlerless licenses at any given time. If one is used, they may purchase another, as long as licenses are available.

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. Investigate alternatives to the current non-parametric tests to determine trends in current metrics.

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, continue to allocate antlerless licenses to reduce the deer population and use DMAP permits to further reduce

deer numbers in specific areas where CWD-positive deer have been detected. Chronic wasting disease is rapidly increasing and spreading. Reducing deer populations is the most practical management option at this time.

8. 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, S. J. Bissell, A. Criscione, P. Doherty, A. Ritchie, C. L. Schilli, T. Winegord, and A. Lanier. 2019. 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, 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. Pages 217-226 *in* D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, editors. Measuring and monitoring biological diversity: standard methods for mammals. 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, 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.

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

United States Department of Agriculture [USDA]. 2020. United State Forest Service. Forest Inventory and Analysis. https://www.fia.fs.fed.us/. Accessed 15 January 2021.

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 in 2020, proportion of juveniles in the antlerless 2020 harvest, and trend in the proportion of juveniles in the antlerless harvest by Wildlife Management Unit (WMU) from 2015 to 2020, Pennsylvania.

WMU	*n*	Proportion of juveniles in antlerless harvest	Trend
1A	422	0.35	Decreasing
1B	1,466	0.31	Decreasing
2A	514	0.32	Stable
2B	503	0.38	Stable
2C	1,070	0.33	Stable
2D	1,208	0.32	Decreasing
2E	658	0.32	Stable
2F	834	0.27	Stable
2G	310	0.24	Stable
2H	69	0.22	Stable
3A	313	0.26	Stable
3B	651	0.35	Stable
3C	1,037	0.29	Decreasing
3D	510	0.29	Stable
4A	571	0.29	Stable
4B	691	0.32	Decreasing
4C	692	0.34	Stable
4D	1,062	0.29	Decreasing
4E	1,015	0.34	Stable
5A	271	0.30	Stable
5B	897	0.36	Stable
5C	865	0.36	Stable
5D	283	0.44	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 2015 to 2019, 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	14	68.6	Good	3.00	Acceptable
1B	13	50.0	Fair	2.85	Acceptable
2A	19	27.7	Poor	3.11	Acceptable
2B	n/a[a]	n/a[a]	n/a[a]	n/a[a]	n/a[a]
2C	36	56.9%	Fair	3.17	Acceptable
2D	32	44.7	Fair	3.06	Acceptable
2E	19	54.2	Fair	3.21	Acceptable
2F	27	68.7	Good	3.04	Acceptable
2G	35	49.6	Fair	3.11	Acceptable
2H	15	50.0	Fair	2.67	Acceptable
3A	14	60.5	Fair	3.14	Acceptable
3B	31	65.8	Good	2.90	Acceptable
3C	26	45.5	Fair	3.27	Acceptable
3D	32	57.9	Fair	3.66	Too high
4A	19	66.7	Good	2.79	Acceptable
4B	23	57.5	Fair	3.17	Acceptable
4C	18	59.1%	Fair	3.11	Acceptable
4D	37	51.5	Fair	2.84	Acceptable
4E	15	63.9	Fair	3.40	Too high
5A	8	63.0	Fair	3.43	Acceptable
5B	12	45.9	Fair	3.25	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, 2020-21. 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	119	2,225	9,000	422	3,559	18,000
1B	398	3,012	11,700	1,466	4,478	17,800
2A	184	2,240	8,100	514	2,780	11,800
2B	87	2,043	6,200	503	3,276	15,000
2C	331	3,559	8,400	1,070	5,600	15,700
2D	303	3,827	12,000	1,208	6,102	18,700
2E	256	2,230	6,500	658	3,719	11,300
2F	573	3,518	10,700	834	3,337	10,000
2G	346	2,811	7,500	310	1,969	6,800
2H	65	951	2,900	69	580	1,600
3A	333	2,169	7,000	313	1,982	6,700
3B	459	2,845	9,100	651	2,635	8,500
3C	431	3,212	10,800	1,037	3,991	14,500
3D	332	2,152	6,200	510	2,217	6,400
4A	196	1,762	5,200	571	3,015	10,800
4B	180	1,807	5,000	691	2,894	10,800
4C	424	2,947	7,000	692	2,696	8,100
4D	438	3,081	9,100	1,062	3,908	12,300
4E	487	2,845	8,600	1,015	3,265	11,200
5A	81	1,288	3,500	271	2,170	6,100
5B	305	3,247	9,600	897	4,914	16,400
5C	244	2,931	8,400	865	5,298	15,200
5D	59	1,370	2,200	283	2,851	6,500
Unk.		27	80		67	200

[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. Starting in 2017-18, specific land inside the DMA's were enrolled in a Deer Management Assistance Program (DMAP) to focus antlerless harvest near known Chronic Wasting Disease-positive locations.

WMU	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
1A	0	0	0	0	0	0	0
1B	0	0	0	0	0	0	0
2A	0	0	0	0	0	0	0
2B	0	0	0	0	0	0	0
2C	429	1,190	1,435	272	687	1,369	47
2D	0	0	0	391	658	1,388	38
2E	0	0	141	469	1,001	1,873	277
2F	0	0	0	2	473	924	0
2G	0	0	0	1	2	5	5
2H	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0
3C	0	0	0	0	0	0	0
3D	0	0	0	0	0	0	0
4A	1,805	2,270	2,213	1,172	1,830	2,624	3
4B	0	0	0	8	116	985	11
4C	0	0	0	0	0	0	0
4D	248	243	333	17	381	655	536
4E	0	0	0	0	0	0	7
5A	0	0	0	1	0	0	23
5B	0	0	0	0	408	545	466
5C	0	0	0	0	15	27	14
5D	0	0	0	0	0	0	0

Table 5. Number of Disease Management Area (DMA) permits and Deer Management Assistance Program (DMAP) permits allocated, sold, reported, reporting rate, antlerless deer harvested, and permits sold per antlerless deer harvested in Pennsylvania's Chronic Wasting DMAs, 2014-15 to 2019-20.

Year	DMA	Permits Allocated	Permits Sold	Permits Reported	Reporting Rate	Reported Harvest	Licenses per Harvest
2014-15[a]	2	13,000	12,170	10,734	0.88	2,482	4.9
2015-16[a]	2	13,500	13,521	12,562	0.93	3,703	3.7
2016-17[a]	2	14,500	14,542	13,388	0.92	4,124	3.5
2017-18[b]	2	7,200	7,200	6,188	0.86	575	4.9
	3	2,800	2,800	2,193	0.78	894	3.2
2018-19[b]	2	14,800	14,748	12,021	0.82	3,039	4.9
	3	7,200	7,200	5,469	0.76	2,128	3.4
	4	2,800	2,455	1,722	0.70	423	5.8
2019-20	2	60,831	30,748	22,647	0.74	5,669	5.4
	3	23,100	15,156	11,958	0.79	4,210	3.6
	4	4,430	3,242	2,253	0.69	576	5.6
2020-21	2	5,850	3,990	2,829	0.71	672	5.9
	3	2,664	1,734	1,219	0.70	278	6.2
	4	4,430	3,307	2,313	0.70	482	6.9

[a] From 2014-15 to 2016-17, DMA2 Permits were available for use throughout DMA2.

[b] Beginning in 2017-18, DMAP permits were available within specific DMAP Units in each DMA.

Table 6. Number of yearling and adult male deer aged, age composition of harvests, and estimated number of 2.5-year-old and older males harvested in Pennsylvania, 1997-98 to 2019-20. 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	Estimate 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	63,800
2012-13	10,588	48	52	69,000
2013-14	9,937	47	53	71,200
2014-15	9,225	43	57	68,000
2015-16	9,762	41	59	81,200
2016-17	9,792	44	56	83,400
2017-18	11,404	43	57	93,400
2018-19	9,485	36	64	94,600
2019-20	8,420	34	66	107,700
2020-21	7,591	36	64	111,900

Table 7. Number of antlerless deer aged and age composition of harvests in Pennsylvania, 1997-98 to 2020-21. 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
2017-18	15,310	19	17	64
2018-19	15,008	17	17	66
2019-20	15,104	16	15	69
2020-21	16,844	17	15	68

Table 8. Pennsylvania Sex-Age-Kill (PASAK) model estimates of post-hunt deer populations by Wildlife Management Unit (WMU), 2011 to 2019, Pennsylvania.

WMU	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Trend
1A	42,420	48,472	55,114	49,169	62,237	65,707	53,244	46,208	51,804	99,568	Stable
1B	51,697	55,713	53,799	47,438	71,669	74,053	81,376	60,756	81,659	95,277	Stable
2A	68,080	53,996	43,379	30,033	48,723	57,963	46,361	44,587	61,486	72,156	Stable
2B	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
2C	64,888	61,386	68,683	66,027	83,350	69,034	113,659	85,400	97,246	76,365	Stable
2D	102,440	113,774	144,084	110,214	117,823	112,499	140,281	104,622	114,679	93,498	Stable
2E	30,384	44,546	45,529	50,549	43,081	43,144	56,635	46,170	62,753	52,578	Stable
2F	53,210	83,063	65,614	61,020	67,152	74,387	108,575	86,836	98,104	112,840	Increasing
2G[b]	58,441	60,019	49,313	40,343	65,521	67,942	81,757	55,219	70,946	85,558	Stable
2H[b]	12,554	13,356	16,537	16,872	15,430	15,704	38,649	18,919	25,314	42,858	Increasing
3A	31,224	41,358	45,317	36,181	49,307	49,426	55,441	39,832	54,040	71,376	Stable
3B	58,481	53,709	63,803	55,249	76,808	80,598	76,249	51,976	62,489	90,795	Stable
3C	64,359	67,720	58,925	67,997	83,206	85,083	79,925	57,169	75,360	94,807	Stable
3D	31,299	29,225	25,127	33,778	28,957	33,302	30,727	33,798	48,663	45,355	Increasing
4A	49,191	36,579	42,196	23,772	48,538	29,746	39,238	40,344	47,047	39,911	Stable
4B	60,340	52,903	50,517	45,362	57,846	55,941	52,407	50,136	54,044	44,691	Decreasing
4C	45,093	45,586	49,072	50,265	55,068	55,311	61,317	55,122	55,238	77,639	Stable
4D	70,495	67,011	61,428	56,905	60,398	63,984	99,997	61,441	71,983	89,963	Stable
4E	44,225	48,318	50,707	59,206	64,923	62,285	70,064	60,055	59,120	77,399	Stable
5A	35,598	28,014	29,715	25,032	20,081	28,581	33,243	25,162	49,801	28,772	Stable
5B	60,723	75,260	63,591	60,538	66,282	73,573	85,790	77,485	76,623	91,713	Stable
5C	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
5D	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]

[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), 2009-10 to 2021-22, Pennsylvania.

WMU	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
1A	42,000	41,705	42,000	42,000	49,000	47,000	46,000	46,000	52,000	48,000	49,000	49,000	40,000
1B	30,000	27,844	30,000	33,000	31,000	30,000	29,000	29,000	35,000	37,000	35,000	41,000	32,000
2A	55,000	54,879	65,000	59,000	49,000	46,000	43,000	43,000	50,000	49,000	46,000	46,000	39,000
2B	68,000	68,000	71,000	67,000	62,000	60,000	61,000	61,000	60,000	58,000	54,000	49,000	49,000
2C	49,000	44,107	58,000	50,000	43,000	38,000	31,000	31,000	31,000	44,000	52,000	58,000	67,000
2D	56,000	50,123	60,000	62,000	61,000	61,000	55,000	55,000	55,000	63,000	66,000	60,000	74,000
2E	21,000	20,407	25,000	21,000	22,000	21,000	21,000	21,000	22,000	27,000	32,000	39,000	42,000
2F	28,000	22,148	34,000	27,000	29,000	27,000	22,000	22,000	24,000	23,000	31,000	36,000	32,000
2G[a]	26,000	15,210	23,000	33,000	28,000	22,000	22,000	21,000	25,500	30,000	26,000	27,000	23,000
2H[a]					6,000	5,500	6,500	6,000	7,000	6,000	6,000	7,000	9,000
3A	26,000	25,247	26,000	26,000	23,000	18,000	19,000	15,000	20,000	22,000	20,000	21,000	19,000
3B	43,000	33,761	40,000	40,000	39,000	33,000	28,000	28,000	30,000	29,000	38,000	33,000	30,000
3C	27,000	26,358	29,000	35,000	35,000	32,000	36,000	36,000	42,000	38,000	46,000	49,000	33,000
3D	37,000	31,622	39,000	39,000	32,000	25,000	25,000	25,000	25,000	25,000	25,000	36,000	36,000
4A	29,000	27,521	28,000	29,000	28,000	28,000	30,000	30,000	30,000	38,000	41,000	49,000	50,000
4B	23,000	22,148	23,000	26,000	24,000	26,000	26,000	26,000	26,000	26,000	32,000	33,000	34,000
4C	35,000	34,351	35,000	35,000	27,000	25,000	25,000	25,000	29,000	30,000	36,000	32,000	29,000
4D	40,000	30,052	37,000	36,000	35,000	33,000	33,000	34,000	34,000	34,000	46,000	45,000	55,000
4E	30,000	26,899	29,000	28,000	26,000	21,000	25,000	25,000	27,500	32,000	34,000	37,000	42,000
5A	19,000	18,269	19,000	19,000	19,000	19,000	19,000	19,000	22,000	23,000	22,000	26,000	31,000
5B	51,000	50,812	50,000	51,000	50,000	49,000	50,000	50,000	57,000	58,000	67,000	60,000	60,000
5C	113,000	121,960	117,000	111,000	103,000	95,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
5D	22,000	22,000	22,000	19,000	18,000	18,000	24,000	30,000	30,000	28,000	29,000	29,000	29,000

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