

PENNSYLVANIA GAME COMMISSION
BUREAU OF WILDLIFE MANAGEMENT
RESEARCH DIVISION
PROJECT ANNUAL JOB REPORT

PROJECT CODE NO.: 06210

TITLE: White-tailed Deer Research/Management

PROJECT JOB NO.: 21001

TITLE: Estimating County Deer Population Sizes & Growth Rates

PERIOD COVERED: 1 July 2002 through 30 June 2003

COOPERATING AGENCIES: None

WORK LOCATION(S): Statewide

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DATE: 17 November 2003

Abstract: We used data on deer reproduction, sex and age of harvested deer, license numbers of successful hunters, and reported harvests to estimate 2002 deer populations by management unit. Wildlife Conservation Officers (WCOs) also conducted winter deer mortality surveys along predetermined routes in their respective districts. Two hundred sixty-three does were used to determine conception and fawning dates. The average reproductive rate was 1.10 embryos/doe with the median conception date of 14 November. The median projected birth date was 31 May. The 2002-2003 overwintering deer density was 25 deer/mi² of land. The 2002-2003 winter deer loss index of 0.32 deer/mile was above other years with mild winters, but well below previously recorded losses. We projected a preseason deer population of 21 to 43 deer per square mile of land for 2003, depending on management unit. New wildlife management units (WMUs) were proposed and approved in 2003. Antler restriction regulations were then modified to a restriction of 4 points per side in WMUs 1A, 1B, 2A, 2B, and 2D, with the remainder of the state having an antler restriction of 3 points per side. Antler restrictions are in effect in special regulations counties. Due to the antler restrictions, a new population model was developed to simulate deer herd dynamics in each WMU. We recommend beginning to decrease deer densities in each WMU, expanding the Deer Management Assistance Program (DMAP) to all landowners, continuing current antler restrictions to allow a rigid evaluation of their effects on deer populations and hunter support, and allowing hunters to purchase and use the entire antlerless allocation without regard to individual limits.

OBJECTIVE

1. To determine deer population sizes and harvest recommendations by management unit.

METHODS

To obtain data on reproduction by age class, WCOs examined female deer killed by various causes from 1 February through 31 May 2002. They recorded location (county, township, and proposed management unit), date killed, cause of death, and number and sex of embryos for each doe on a form attached to a deer jaw envelope. They measured embryos so that we could determine conception and projected birth dates and removed 1 side of the lower jaw from each deer for age determination. Jaws were forwarded to wildlife biologists who made the age assignments in July 2002. Personnel in the Bureau of Automated Technology Services (BATS) processed the reproductive data and provided summary reports for the state and each county.

During the 2002 rifle seasons for deer, 32 data collection teams examined deer in assigned areas. Each team spent 3 days during the first week of the rifle season, 2 days during the second week of rifle season, and 2 days after the close of deer season. Data collected were ages, sexes, WMUs and counties of harvest, and hunting license numbers of successful hunters of harvested deer found in butcher shops and other locations. Deer teams determined deer ages using tooth wear and replacement (Severinghaus 1949). Data collection teams also recorded points of antlers to determine antler characteristics by year class.

BATS personnel entered and processed data from these biological collections and from 2002-2003 deer harvest report cards submitted by hunters. BATS also provided a PC download for population analysis. For each county the download included: the reported antlered harvest, the reported antlerless harvest, reporting rates, age and sex breakdowns of the harvest, reproductive data, combined reported antlerless rifle and antlerless archery harvests, and the total antlerless rifle and archery harvests. All categorized harvest data were converted from counties to WMU. Harvest data were then incorporated into a population model to simulate historical deer herd dynamics for each WMU. Estimated herd numbers were then projected to predict a 2003 pre-hunt deer herd size for each WMU and the number of antlerless licenses required to stabilize or decrease pre-hunt deer densities by 5% were calculated by simulating deer herd dynamics between 2003 and 2004.

It is noteworthy that a new population model was used in 2003. A basic assumption to the population model used prior to this year was that the percent yearling males in adult buck harvests reflected the proportion of yearling males in the actual population. The intent of the revised antler restriction regulation was to intentionally reduce buck harvest mortality rates on yearling bucks. Therefore, the percentage of yearling bucks in annual buck harvests would not be expected to reflect the live population thereby invalidating the old model. The new population model is often referred to as an "accounting model" where the "balance" of deer changes as "withdrawals" occur in the form of non-hunting and hunting mortality and "interest" is accrued in the form of newborn fawns. Deer herd dynamics were modeled in each WMU with a beginning year of 1998 to align the population estimates from the new model with those of the old model.

In late March and early April, WCOs conducted winter deer mortality surveys in their assigned districts. Each WCO walked 3 1.5-mile routes along stream bottoms to locate possible winter losses. They recorded the sex and age of all dead deer found and submitted the data to us for analysis. We converted the data to a deer/mile index and compared it with previous winter loss index values to decide if we needed to adjust any projected county estimates for excessive winter losses.

RESULTS

WCOs examined 520 females during the 2002 prefawning season. Three hundred and thirty-nine were pregnant and 263 were usable for determining conception dates. Twenty-six percent of the fawns, and 91 percent of the adults were pregnant. Pregnant fawns averaged 1.13 embryos/doe. Pregnant adults averaged 1.80 embryos/doe. The average reproductive rates for pregnant and barren fawns and adults were 0.29 and 1.64 embryos/doe, respectively. The average reproductive rate for all females was 1.10 embryos/doe. The median conception date for all does was 14 November. Eighty-six percent of all breeding occurred between 16 October and 16 December (Fig. 1), with the median date fawns bred as 5 December, 21 days later than adult does. The median projected birth date for all fetuses examined was 31 May (Fig. 2).

Statewide, WCOs found 0.32 dead deer/mile on winter survey routes in 2003. This is an increase over previous years, indicating some loss did occur due to winter severity. However, in most counties, winter losses were below the high losses recorded in 1978 (Table 1).

Hunters harvested 517,529 deer in the 2002-2003 deer seasons. The antlered harvest was 165,416, a decrease compared to the 2001-2002 harvest of 203,247.

New antler restriction regulations were the reason for the buck harvest decline. The antlerless harvest was 352,113, up from 282,767 in 2001-2002. The antlerless harvest increase was due to antlerless license increases. The increased allocation was designed to remove enough antlerless deer to allow for the bucks protected by new antler restriction regulations, without an overall increase in the deer population. This was also the second year of concurrent deer season in Pennsylvania. This factor, combined with new antler restriction regulations could have increased hunter selection for antlerless deer. We expect hunter behavior to become more consistent in future years as Pennsylvania hunters adjust to the longer, concurrent deer season initiated this year.

Modeled statewide deer densities (post-hunt) averaged about 25 deer/mi² (range = 12-36 deer/mi²) and averaged 122% (range = -20-216%) over individual WMU goals (Table 2). While modeled statewide deer densities (pre-hunt) increased by 20% from 1998-2003, population growth has stabilized over the past 3 years averaging an increase of 1.6% (Fig. 3). Model simulations predicted a 2003 pre-hunt deer density for each WMU ranging between 16 and 49 deer/mi² (Table 3).

Several recommendations were proposed and accepted by the Commissioners at the January meeting and approved in April. The board approved the new WMUs as a replacement of the county-based unit system for management. An antler restriction of 4 points on 1 antler was approved in the WMUs of 1A, 1B, 2A, 2B, and 2D, with the remaining WMUs (including special regulations counties) having an antler restriction of 3 points per side. There was also a clarification of what defines a "point" for antler restriction regulations as "any antler projection at least one inch in length from base to tip. The main beam tip shall be counted as a point regardless of length." This definition includes the brow point and is congruent with the methodology we used to define antler points. A Deer Management Assistance Program (DMAP) for public land or private land enrolled in the PGC's public access program was also approved. The Board also approved the use of crossbows in WMUs 2B, 5C and 5D during the 2-week concurrent rifle deer season (1-13 December) and the late firearms deer seasons (26 December-10 January). Crossbows were already legal statewide during the 2-week concurrent rifle deer season.

Other important regulations that remain in place are a 12-day concurrent antlered and antlerless rifle season for all hunters; a 7-day antlerless muzzleloader season in October; a 3-day antlerless rifle season in October for junior, senior, disabled, and military license holders; sale of unsold antlerless licenses, up to 2 per hunter, that remain after all hunters have had an opportunity to purchase one; and field possession regulations that allow a hunter to harvest another deer after tagging the first deer harvested.

The Board also approved the 2003-2004 antlerless deer license allocation of 973,000. Last year, hunters purchased 1,010,693 antlerless deer licenses, which resulted in a harvest of 352,113 antlerless deer.

RECOMMENDATIONS

1. Beginning to decrease deer densities in each WMU toward established deer density goals stated in Table 3.
2. Expand DMAP to allow all landowners a method of managing deer herds on their properties inline with their land-use objectives.
3. Keep current antler restriction regulations to allow a rigid evaluation of their effects on the deer population and changes in hunter support over time.
4. Allow hunters to purchase and use the entire antlerless allocation without regard to individual limits.

LITERATURE CITED

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

Table 1. Dead deer found on winter survey routes in 2003 and dead deer found/mile surveyed in 2003 and 1978 in Pennsylvania.

County	2003		Dead deer/mile	
	Miles	Dead deer	2003	1978
Adams	9.50	2	0.21	0.33
Allegheny	10.25	5	0.49	0.15
Armstrong	8.70	1	0.11	0.11
Beaver	7.25	13	1.79	0.00
Bedford	14.00	14	1.00	1.35
Berks	15.10	4	0.26	0.00
Blair	18.00	4	0.22	4.00
Bradford	16.50	8	0.48	0.81
Bucks	9.50	1	0.11	
Butler	10.20	0	0.00	0.09
Cambria	9.00	9	1.00	2.18
Cameron	4.50	2	0.44	13.60
Carbon	15.00	2	0.13	0.13
Centre	17.50	7	0.40	3.35
Chester	15.00	0	0.00	0.00
Clarion	9.00	2	0.22	1.88
Clearfield	14.50	4	0.28	5.17
Clinton	11.00	3	0.27	0.87
Columbia	11.50	4	0.35	0.83
Crawford	22.50	4	0.18	0.33
Cumberland	9.50	1	0.11	0.55
Dauphin	12.25	4	0.33	1.67
Delaware	1.50	0	0.00	
Elk	9.15	3	0.33	1.86
Erie	15.70	8	0.51	0.08
Fayette	11.90	7	0.59	0.00
Forest	14.25	1	0.07	0.42
Franklin	11.10	4	0.36	0.29
Fulton	4.50	0	0.00	0.75
Greene	9.00	9	1.00	0.83
Huntingdon	15.10	3	0.20	0.95
Indiana	11.00	0	0.00	2.16
Jefferson	11.10	6	0.54	1.00
Juniata	5.80	0	0.00	2.67
Lackawanna	8.80	7	0.80	2.24
Lancaster	17.20	0	0.00	0.00
Lawrence	4.50	0	0.00	0.33
Lebanon	4.50	0	0.00	
Lehigh	5.00	2	0.40	0.00
Luzerne	16.00	4	0.25	0.78
Lycoming	25.20	9	0.36	0.70
McKean	16.20	5	0.31	1.23
Mercer	9.50	2	0.21	0.00
Mifflin	6.25	0	0.00	0.77
Monroe	14.30	0	0.00	4.10
Montgomery	10.00	1	0.10	0.14
Montour	4.50	1	0.22	0.00
Northampton	5.90	3	0.51	
Northumberland	4.50	0	0.00	1.67
Perry	8.70	2	0.23	1.01
Philadelphia	0.00	0		
Pike	10.60	5	0.47	4.33
Potter	21.60	8	0.37	3.69
Schuylkill	9.00	0	0.00	0.74
Snyder	5.55	0	0.00	0.63
Somerset	18.55	16	0.86	3.93
Sullivan	4.50	0	0.00	0.75
Susquehanna	10.20	5	0.49	3.97
Tioga	24.00	9	0.38	4.17
Union	3.00	0	0.00	1.09
Venango	10.00	3	0.30	0.38
Warren	21.00	4	0.19	2.10
Washington	10.25	4	0.39	0.29
Wayne	12.20	4	0.33	16.42
Westmoreland	14.50	7	0.48	3.03
Wyoming	4.50	0	0.00	0.00
York	23.00	5	0.22	
2003 Totals	753.85	241	0.32	

County	2003		Dead deer/mile	
	Miles	Dead deer	2003	1978
1978 Totals	686.05	1,330		1.94

Table 2. Winter deer density goals and estimated winter densities from Jan 1999 through Jan 2003 for Pennsylvania. Wildlife Management Unit (WMU) 5D is excluded due to limited harvest data.

WMU	Goal ^a	Post-hunt deer density estimate (Jan) ^b				
		1999	2000	2001	2002	2003
1A	9	20	23	23	24	26
1B	12	22	25	25	25	25
2A	13	36	39	38	37	36
2B	10	24	26	28	28	30
2C	15	23	26	27	30	31
2D	14	31	33	31	31	29
2E	14	25	26	25	25	24
2F	17	27	30	28	27	24
2G	15	14	15	14	13	12
3A	15	23	26	28	30	31
3B	13	21	24	26	28	29
3C	14	24	27	28	28	28
3D	13	16	19	21	22	23
4A	15	25	28	28	29	30
4B	11	20	23	24	27	29
4C	12	20	23	24	25	26
4D	14	20	23	22	23	24
4E	11	19	21	22	23	23
5A	8	14	16	18	19	21
5B	5	13	15	16	17	17
5C	6	17	18	19	19	19

^aEstimated population density that can be supported during winter without over-browsing forest habitats, estimated from forest composition data.

^bMinimum deer density estimates derived from simulation modeling.

Table 3. Winter deer density goals, current deer density estimates, antlerless allocations and projected harvests for 2003, and simulated changes in deer density based on predicted antlerless harvests in each Wildlife Management Unit, Pennsylvania, 2003-2004.

WMU	Density Goals ^a	Jan 2003 Deer Density ^b	Pre-hunt 2003 Deer Density ^b	% Population Increase	2003 Antlerless Licenses Issued	Projected Antlerless Harvest (2003)
1A	9	26	38	46	44,000	17,000
1B	12	25	36	44	37,000	16,500
2A	13	36	49	45	45,000	16,500
2B	10	30	45	36	45,000	12,000
2C	15	31	44	50	65,000	24,000
2D	14	29	42	42	58,000	24,000
2E	14	24	34	45	29,000	12,000
2F	17	24	33	42	44,000	18,000
2G	15	12	16	38	52,000	19,500
3A	15	31	42	33	28,000	11,500
3B	13	29	39	35	45,000	16,000
3C	14	28	38	34	40,000	17,000
3D	13	23	33	36	50,000	15,500
4A	15	30	41	43	37,000	12,500
4B	11	29	41	37	38,000	11,500
4C	12	26	37	41	46,000	14,500
4D	14	24	34	42	58,000	19,000
4E	11	23	33	42	38,000	12,000
5A	8	21	30	43	28,000	8,000
5B	5	17	27	59	60,000	17,500
5C	6	19	29	53	66,000	16,000
5D ^d	---	---	---	---	20,000	---

^aEstimated population density that can be supported during winter without over-browsing forest habitats, estimated from forest composition data.

^bMinimum deer density estimate derived from simulation modeling.

^cPercent change in pre-hunt population size between years based on simulation modeling.

^dDeer herds cannot be modeled in WMU 5D due to limited harvest data.

Fig. 1. Conception time periods based on 263 roadkilled does, Pennsylvania, 2002.

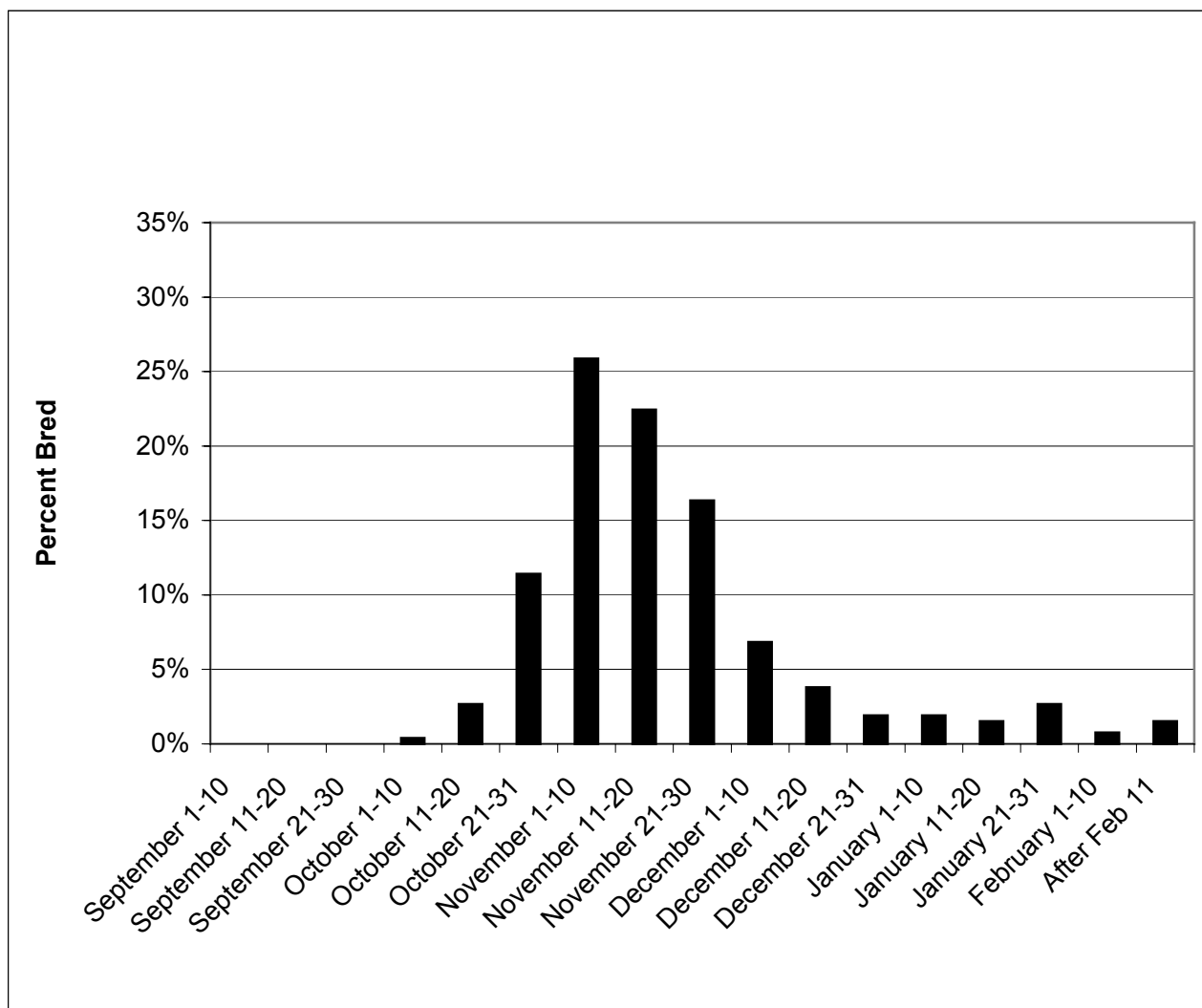
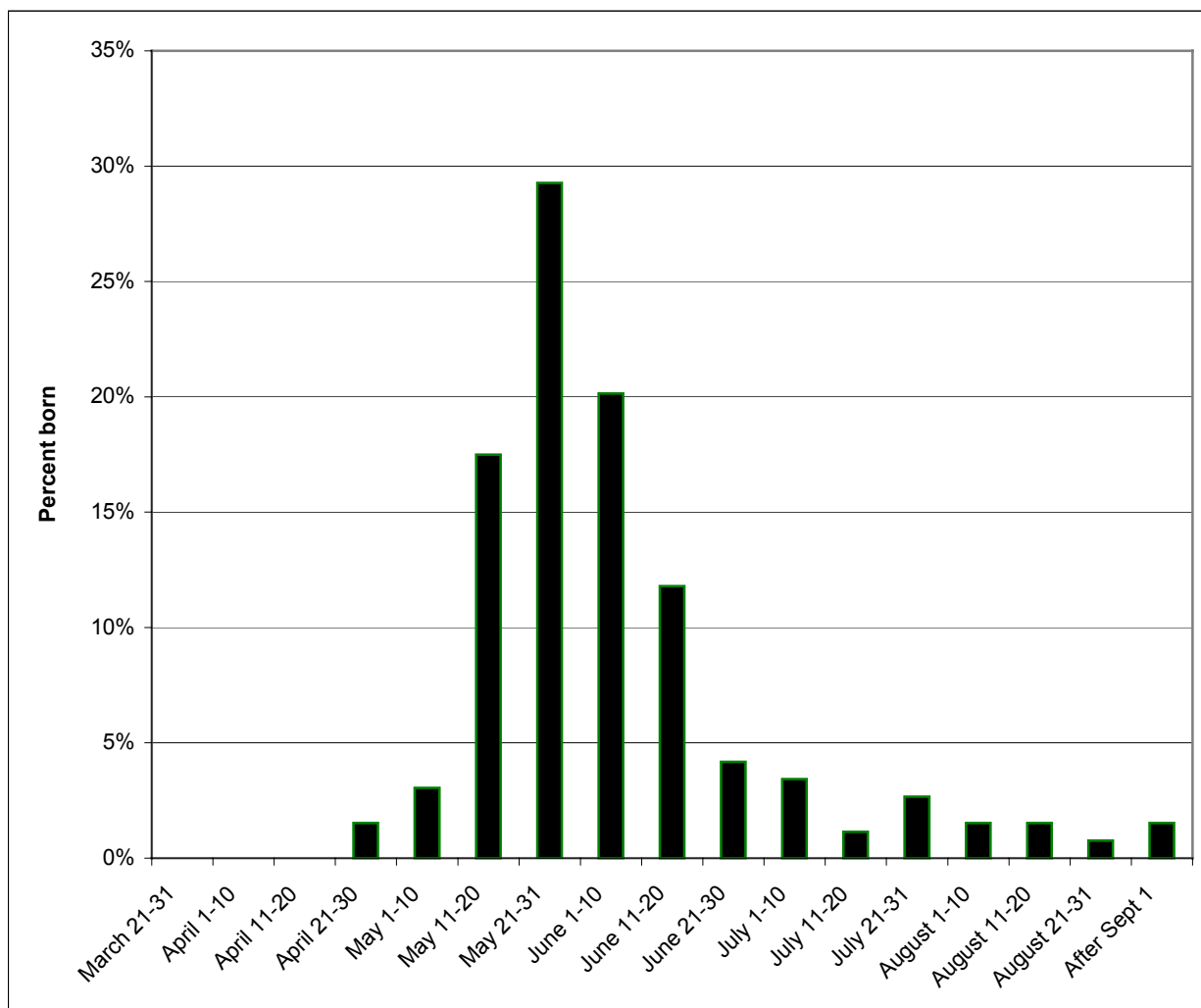


Fig. 2. Projected birth dates of fetuses of 263 roadkilled does, Pennsylvania, 2002.



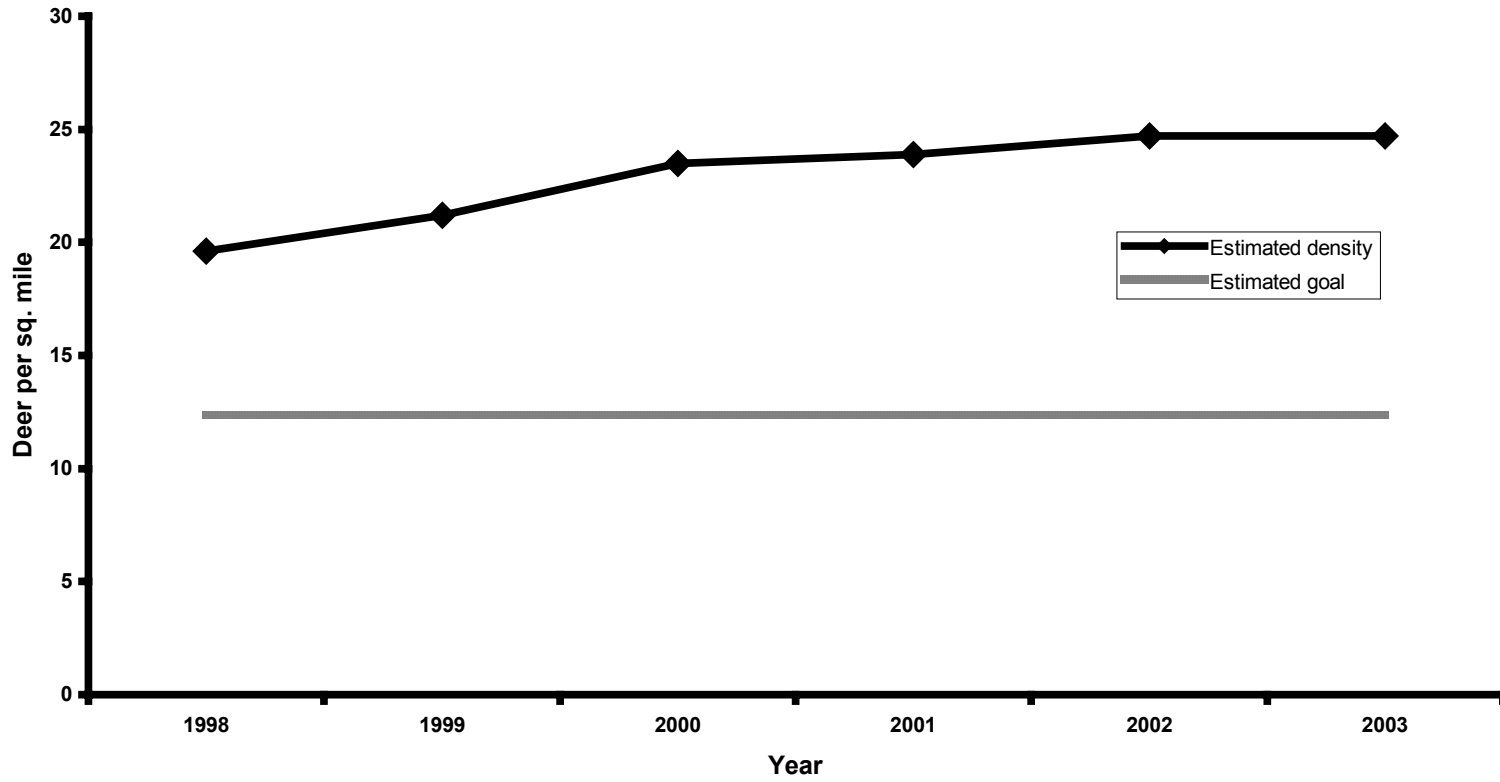


Fig. 3. Minimum statewide deer densities estimated in January of each year, Pennsylvania, 1998-2003. Population density estimates derived from simulation modeling.