

2008-09 RUFFED GROUSE POPULATION STATUS IN VIRGINIA

by

GARY W. NORMAN

*Virginia Department of Game & Inland Fisheries
P.O. Box 996
Verona, Virginia 24482*

Abstract: Two spring drumming surveys and two fall hunter surveys were conducted to monitor ruffed grouse population status in Virginia. Spring 2008 breeding population indices were below-average based on drumming counts from roadside surveys. However, drumming rates reported by spring gobbler hunters during the first 2-weeks of the season increased slightly. Cooperating grouse hunters reported 0.72 grouse flushed per hour during the 2008-09 hunting season. Fall flushing rates (0.72 flushes/hr) were comparable to last year (0.69 flushes/hr). These rates were among the lowest ever recorded during the survey history. The long-term flushing rate is 1.12 birds per hour. Flushing rates have also declined in many states in the Mid-Atlantic region in recent years. Bow hunter survey data also indicate grouse observations declined slightly between the deer archery seasons in October 2007 and 2008. The percentage of juvenile birds harvested (33%) by cooperating hunters in 2008 was the below-average (41%). Grouse hunter satisfaction during the 2008-09 season (2.8 on scale of 1-7) was similar to last year (2.9). Survey data suggest little change or a slight decline in Virginia's grouse populations during 2008-09. Trend analyses suggest significant long-term annual declines in grouse breeding population levels based on drumming indices from roadside surveys (-2.6%) and spring gobbler hunter surveys (-2.6%) in Virginia over the past 15 years.

Ruffed grouse (*Bonasa umbellus*) population management is the responsibility of the Virginia Department of Game and Inland Fisheries (VDGIF). The VDGIF seeks to maintain grouse populations at levels that provide quality hunting and nonconsumptive opportunities in Virginia's occupied grouse range. The ruffed grouse is a popular game bird in Virginia. Approximately 13,342 hunters hunted 65,390 days to harvest 13,078 grouse during the 2008-09 season (Jagnow et al. 2009). Grouse harvests are regulated by adjusting season lengths and bag limits, and annual surveys of grouse populations and harvests are used to help evaluate the status of ruffed grouse in Virginia.

The Department would like to thank the individuals who assisted with ruffed grouse and spring gobbler surveys. Appreciation is extended for their time and effort to provide valuable information for ruffed grouse management in Virginia. We would also like to thank VDGIF and U.S. Forest Service (USFS)

personnel for their assistance with the roadside drumming surveys. Special thanks are given to Mr. J. W. Coleman and H. R. Mobley for volunteering their time to assist with the drumming survey. I appreciate Cale Godfrey's efforts to review and edit this report.

METHODS

Grouse Hunter Survey

A non-random volunteer group of cooperating hunters (cooperators) were included in the 2008-09 survey. Cooperators were solicited from VDGIF quail and woodcock survey participants, Virginia members of the Ruffed Grouse Society and Quail Unlimited, popular articles, and press releases.

Data sheets were provided to cooperators (Appendix A). Cooperators were asked to report the number of

hours they hunted, grouse flushed, and grouse killed by county and land ownership. Cooperators were also asked to rate quality of each hunt on a scale from 1 (poor) to 7 (excellent).

To determine sex and age related information on the grouse population, cooperators were asked to provide tail and wing feather samples from any birds they harvested. Age (juvenile or adult) was determined by examining the curvature of the tenth primary, the presence or absence of sheathing, and the length of the 9th primary (Davis 1969). Where equivocal age determinations were noted, curvature of the wing tip and feather sheathing were considered the most reliable techniques. Sex was determined by examining the length of plucked mid-rectrix feathers (Davis 1969). Chi-square analyses were used to compare age and sex frequency distributions by month of the season and by region (Fig. 1, 2) of the state.

Flushing and harvest rate were used as indices to fall population density and long-term population trends. Age distribution of hunter-collected feather samples was used as an index to annual recruitment.

Grouse hunting season dates were 25 October 2008 to 14 February 2009. The bag limit was 3 per day. The season was closed in counties east of Interstate 95.

October Bow Hunter Survey

A non-random volunteer group of archery hunters reported grouse observations while hunting deer in October. Participating archers provide information on grouse seen, hours hunted, and the county hunted (Norman and Fies 2004).

Spring Gobbler Hunter Survey

During Virginia's spring gobbler season, a non-random volunteer group of hunters, primarily National Wild Turkey Federation members, provided information on the county hunted, number of hours hunted, number of grouse heard drumming, and number of grouse flushed (Norman 2005). Drumming rates (grouse/hunt) were used as indices to spring grouse population densities and long-term population trends. Drumming analyses were based on the first 2-weeks of the spring gobbler season

when drumming rates were highest. Overall means and estimates were calculated as linear functions of annual estimates.

Roadside Drumming Survey

Survey routes ($n = 45$) within Virginia's occupied grouse range were randomly chosen using 7.5 minute topographic maps. Routes began at the intersection of secondary roads nearest the center of selected topographic maps. A random direction of travel was assigned to the starting point and at subsequent road intersections. Routes were at least 10 miles in length with 10 listening stops at 1-mile intervals. Listening stops were skipped and the route lengthened if hazardous road conditions were found within 100' of the 1-mile odometer reading. Each route was surveyed twice, once each during the 2nd and 3rd weeks of April. The survey began 30 minutes before sunrise. At each stop, observers recorded the number of drums during a 4-minute listening period and any disturbance which affected the observer's ability to hear drumming (Appendix B). Stops with high disturbance were censored. Personnel of the VDGIF, USFS, and volunteers conducted the surveys. Overall means and estimates were calculated as linear functions of annual estimates.

Breeding Population Trend Analysis

Population trends were based on the percent change in numbers of drums heard and numbers of drumming grouse heard in the roadside drumming survey and spring gobbler hunter survey. Drumming data were analyzed with a multiplicative model using a log transformation and linear regression (Sauer and Geissler 1990):

$$y = ab^xe$$

where, y = number of drums per stop or number of drumming grouse per hunt, x = year, a = intercept, b = trend, and e = error term. Logarithms were used to make the model a linear regression: $\ln(y + 0.05) = \ln(a) + \ln(b)x + \ln(e)$. The slope of the linear regression, $\ln(b)$, was back-transformed to estimate b (Bradu and Mundlak 1970) where,

$$b = e^{[\ln(b) - 0.5\text{var}\{\ln(b)\}]}$$

The percent change per year was $100(b-1)$. Trends were considered significant if the regression was significant ($P < 0.05$).

RESULTS

2008-09 Fall Population Surveys and Trends

2008-09 Grouse Hunter Survey. Cooperating grouse hunters ($n=53$) reported data from 748 hunts (Table 1). Cooperators averaged hunting 14.1 days and 3.4 hours per hunt. Hunters reported flushing 1,858 birds while hunting 2,567 hours (Table 2). Flushing rates were slightly higher in January (Table 2). Throughout the season hunters averaged flushing 0.72 grouse per hour. The 2008-09 season tied 1976-77 season with the second lowest flushing rate during the survey history (Table 3). The long-term average is 1.12 grouse per hour. Flushing rates in the past 2-years have been significantly below the 2001-02 season record of 1.61 grouse flushed per hour and the long-term average. Flushing rates in most states in the Mid-Atlantic region are also showing a downward trend. Flushing rates from most states over the past several years have been below 2001 levels (Fig. 6).

Cooperators harvested 151 grouse or 2.8 grouse per cooperator last season. Little difference in harvest rates (kill/hr) was found in months of the season (Table 2).

Cooperators in the Southern Region of Virginia's grouse range have typically reported higher flushing rates than cooperators in the Northern Region (Table 4, Fig. 1). During the 2008-09 season flushing rates in Northern Region (0.79 grouse/hr) were slightly higher than the Southern Region (0.62 grouse/hr). However, harvest rates were essentially the same (0.06) between the regions, and hunt quality indices were essentially the same between the Northern (2.8) and Southern Regions (2.7).

Cooperators hunting on private lands reported similar flushing rates (0.75) to cooperators hunting on federal lands (0.75). Hunt quality ratings were identical on private lands (2.8) and federal lands (2.8). Limited data were available on state lands.

The average quality of hunt rating for cooperating grouse hunters was 2.8 during the 2008-09 season. This average appears to be steadily declining although previous years (2003-04) have had equally low hunt quality ratings (Table 1). Hunt quality

ratings tended to increase in the latter months of the season (Table 2).

2008-09 Bowhunter Survey. Bowhunters ($n = 331$) reported seeing 127 grouse on 4,735 bow hunts in the 2008 early archery season. In counties west of the Blue Ridge Mountains, which is the primary grouse range in Virginia, archers reported seeing 1.6 grouse per 100 hours of hunting. This rate is slightly lower than last year (1.8 grouse/100 hr). Archers reported seeing a high of 5.2 grouse per 100 hours in the 1997 season. Recent grouse observation rates have been the lowest recorded in the survey history (Fig. 5).

2008 Reproduction

2008-09 Grouse Hunter Survey. Cooperators submitted 94 usable wings for age and sex determination. Juvenile birds comprised 33% of the sample with a ratio of 0.8 juvenile birds per adult female (Table 3). The 2008-09 recruitment index of juvenile birds in the harvest was lower than the long-term average (41%).

Juveniles normally comprise a large percentage of the harvest in the early months of the season and adults typically comprise the majority of the harvest at the end of the season. This pattern was suggested in the 2008-09 season as juveniles comprised most of the November harvest (Table 5). Age ratios were not significantly different by month ($X^2 = 3.8$, $df = 4$, $P=0.43$). Unlike 2007, age ratios were not different between regions ($X^2 = 0.5$, $df = 1$, $P = 0.83$). Males comprised 49% of the harvest (Table 3). Harvest sex ratios were not different ($X^2 = 3.8$, $df = 4$, $P=0.43$) by month (Table 5) of the season or between regions ($X^2 = 0.2$, $df=1$, $P=0.68$); Table 4).

2009 Spring Population Surveys and Trends

2009 Road Side Drumming Routes. Fifty-eight drums were heard during 45 roadside drumming survey routes that were ran twice. The mean number of drums heard per route was 0.6 (Fig. 3). The 2009 suggests breeding populations declined 33% compared to 2008. The roadside survey drumming rate was below the long-term survey average (1.2 drums/route).

2009 Spring Gobbler Hunter Survey. Cooperating spring gobbler hunters ($n=331$) reported hearing 225 drummers and flushing 48 ruffed grouse during 670 hunts. This survey took place during the first 2-weeks of the spring gobbler season in Virginia's primary grouse range (Fig. 3). A drumming rate of 0.34 grouse/hunt and a flushing rate of 0.07 birds/hunt were reported by these spring gobbler hunters (Fig. 3). The 2009 drumming rate was below the survey average of 0.60 drumming grouse/hunt. The Northern Region was the only region to show an increase among the regions (Fig. 4).

Long-Term Trends. Trend analyses of the roadside drumming data suggest that breeding population levels have declined 2.6% annually over the past 15 years ($P<0.01$). Trend data (Fig. 3) from the spring gobbler hunter survey also suggested a 2.6% annual decline over the past 15 years ($P<0.01$).

DISCUSSION AND SUMMARY

Across the board, it is difficult to find any good news to talk about regarding recent trends or densities in grouse populations in Virginia. At some point in time, conditions may improve and grouse populations may turn-around. From a habitat perspective, the expectations for large-scale wildlife management on public lands in grouse range are poor. The loss of early succession habitat is believed to be one of the primary, or perhaps, the primary factor for the downward trend. At some point in time, grouse populations will hopefully stabilize and no further declines will be seen. Eventually without active habitat management, our grouse populations may become dependent on mountain laurel and rhododendron for cover. Mountain laurel can also serve as a food source, but it contains significant amounts of tannins that limit the birds' diet of this food.

In our oak forests, there is some hope that several bumper crops of acorns may stimulate grouse populations by improving reproductive rates. From our research, we have found that chick

survival is higher when hens have been feeding over-winter on acorns. Hens tend to be in healthier condition and have more fat reserves when their diets are primarily acorns. The acorn crop (red and white) in the northern part of grouse range was not as good as the southern part in 2008. These conditions may make for improved reproduction in the southern mountains in 2009.

While discouraging, the trends in the grouse populations are similar regardless of the survey methodology. From a statistical standpoint, the low number of grouse hunters participating in the cooperator survey leads to some uncertainty in the survey results. This decline could be due to hunters losing interest in the survey or actually quitting grouse hunting. An effort will be made this year to recruit new grouse hunters. However, our sample size of bowhunters and spring gobbler hunters is comparably high and the results of these surveys reflect similar downward trends. It seems unequivocal that the data from all of these surveys concur and the results are discouraging regarding population trends. The same uncertainty in survey results also exists for our data on grouse reproduction. The sample size of usable feathers we received was less than 100. When evaluated by region or month, confidence in the accuracy of these estimates wanes. Better sample sizes of grouse feathers are needed in the future.

Predictions for the 2009-10 season are speculative at best. Going into the 2009 spring season we found lower numbers of drummers, which should reflect the base or foundation of our grouse population. Fall populations are a reflection of these breeding populations and reproductive success. An excellent reproductive season can result in a significant increase in the population. Likewise a poor reproductive season can lead to lower recruitment and lower or negative growth. Clearly, we need a good reproductive season to improve grouse numbers.

While desperately needed, reproduction in 2009 may have been negatively impacted by the amount of rainfall during the brood season. Like most gallinaceous birds, extended cold and wet conditions stress both the chicks' ability to thermoregulate and the hens' ability to effectively brood or shelter the young birds. While we had

these extended rainfall conditions during the brood period, the temperatures were mild and the chicks' ability to thermoregulate their body temperature may not have been compromised.

Grouse hunter satisfaction ratings in recent years have been low (range 2.7-3.1) relative to the 2001 season where cooperators rated the season as 4.0 on a scale of 1-7. The declining trend in grouse populations has likely contributed to the declining numbers of grouse hunters and grouse harvests (Table 6). The number of grouse hunters has declined approximately 50% in the past 25 years.

The George Washington National Forest is currently undergoing a review of its management plan, although the process is under-review due to legal issues. The Department is recommending and supporting science-based management of our National Forests that provides a diversity of habitats, particularly for those declining species that require early succession habitats. We urge everyone to become involved in the planning process and express their opinions about management of the George Washington National Forest. The Forest Service is accepting public comments on the future management of the George Washington National Forest on the following web address:

<http://www.fs.fed.us/r8/gwj/forestplan/revision/index.shtml>

Hunting grouse in the southern Appalachians remains a challenging sport as evidenced by the return of 1 grouse for every 17 hours of hunting. Many thanks to those avid grouse hunters that continue to pursue the king of game birds and support the Department with our survey and monitoring of grouse populations.

LITERATURE CITED

- Bumann, George B. 2002. Factors influencing predation on ruffed grouse in the Appalachians. M. S. Thesis, Virginia Tech, Blacksburg, VA.
- Davis, J. A. 1969. Aging and sexing criteria for Ohio ruffed grouse. *Journal of Wildlife Management* 33:628–636.

- Fies, M. and G. W. Norman, 2004. 2003 Virginia Spring Gobbler Survey. Virginia Department of Game and Inland Fisheries, Richmond, Virginia, USA.
- Jagnow, C. P., J. Howell, and D. E. Steffen. 2008. Virginia Survey of Hunter Harvest, Effort and Attitudes: 2006-07. Virginia Department of Game and Inland Fisheries, Wildlife Resource Bulletin No. 08-02. Richmond, Virginia, USA.
- Norman, G. W. 2005. 2004 Virginia Spring Gobbler Survey. Virginia Department of Game and Inland Fisheries, Richmond, Virginia, USA.

Table 1. Harvest, effort, and satisfaction summary of cooperating ruffed grouse hunters in Virginia.

Year	Coop. (n)	Hunts (n)	Hunts/ Season	Hours/ Hunt	Grouse/ Season	Kill/ Hour	Flush/ Hour	Hunt Qtly. ¹
1990-91	110	1,241	11.3	4.1	5.5	0.12	1.03	
1991-92	93	1,204	12.9	4.0	5.2	0.10	0.98	
1992-93	81	1,106	13.7	4.0	6.1	0.11	1.01	
1993-94	61	668	11.0	3.6	3.6	0.09	1.10	
1994-95	84	1,040	12.4	3.9	5.3	0.11	0.97	
1995-96	70	780	11.1	3.7	4.8	0.12	1.50	3.2
1996-97	114	1,269	11.1	3.9	5.4	0.13	1.26	3.6
1997-98	87	1,098	12.6	3.7	5.8	0.12	1.33	3.6
1998-99	69	963	13.9	3.3	5.5	0.12	1.11	3.4
1999-00	93	1,013	10.9	3.7	4.5	0.11	1.01	2.8
2000-01	62	904	14.5	3.7	7.9	0.15	1.45	3.6
2001-02	80	1,082	13.5	3.7	8.9	0.18	1.61	4.0
2002-03	64	851	13.3	3.6	6.1	0.13	1.11	3.2
2003-04	60	779	13.0	3.5	4.5	0.10	0.92	2.7
2004-05	94	1,275	13.6	3.3	4.8	0.11	1.03	3.1
2005-06	63	888	13.8	3.3	4.5	0.10	0.85	3.0
2006-07	54	830	15.4	3.4	5.9	0.11	1.01	3.0
2007-08	75	887	11.8	3.5	2.7	0.07	0.69	2.9
2008-09	53	748	14.1	3.4	2.8	0.06	0.72	2.8

Hunt Qtly.¹ = Hunting quality based on a scale of 1 (poor) to 7 (excellent).

Table 2. Monthly harvest, effort, and satisfaction summary of cooperating ruffed grouse hunters in Virginia during the 2008-09 season.

Month	Days Hunted	Hours Hunted	Grouse Flushed	Flush/ Hour	Grouse Killed	Kill/ Hour	Hunt Quality ¹
October	62	224	134	0.60	7	0.03	2.4
November	78	270	111	0.41	4	0.01	2.2
December	226	717	481	0.67	37	0.05	2.7
January	268	946	813	0.86	69	0.07	3.0
February	114	411	319	0.78	34	0.08	2.9
Season ²	748	2,567	1,858	0.72	151	0.06	2.8

Hunt Quality¹ = Hunting quality based on a scale of 1 (poor) to 7 (excellent).

Season² = Season totals exceeds monthly totals because some hunts without dates were included.

Table 3. Sex ratios, flushing rates, and age distribution of ruffed grouse harvested by cooperating hunters in Virginia.

Season	% Males	% Females	% Juvenile	Flushes/Hour
1973-74	68	32	46	1.31
1974-75	67	33	26	1.00
1975-76	68	32	38	0.98
1976-77	64	36	20	0.72
1977-78	66	34	23	0.90
1978-79	67	33	34	1.21
1979-80	62	38	33	1.21
1980-81	65	35	36	1.44
1981-82	62	38	32	1.36
1982-83	62	38	40	1.57
1983-84	60	40	34	1.17
1984-85	59	41	43	1.17
1985-86	64	36	43	1.18
1986-87	62	38	41	1.40
1987-88	62	38	42	1.19
1988-89	67	33	22	0.83
1989-90	65	35	55	1.05
1990-91	62	38	59	1.03
1991-92 ^a	53 ^a	47 ^a	50	0.98
1992-93	57	43	47	1.01
1993-94	54	46	52	1.10
1994-95	63	37	32	0.97
1995-96	50	50	57	1.50
1996-97	52	48	43	1.26
1997-98	48	52	46	1.33
1998-99	56	44	46	1.11
1999-00	58	42	28	1.02
2000-01	52	48	47	1.45
2001-02	51	49	50	1.61
2002-03	57	43	38	1.11
2003-04	54	46	52	0.92
2004-05	62	38	52	1.03
2005-06	58	42	48	0.85
2006-07	46	54	47	1.01
2007-08	63	37	27	0.69
2008-09	49	51	33	0.72
Average	59	41	41	1.12

^a Davis (1969) sex criteria adopted.

Table 4. Age and sex composition of ruffed grouse harvested and flush rates by region.

Year	Percent Female		Percent Juvenile		Flushing Rate	
	North	South	North	South	North	South
1995-96	49	53	62	54	1.47	1.56
1996-97	51	45	38	46	1.17	1.37
1997-98	55	47	45	48	1.29	1.41
1998-99	42	47	44	49	1.06	1.20
1999-00	47	36	28	30	0.95	1.17
2000-01	48	48	43	52	1.36	1.64
2001-02	48	50	50	50	1.61	1.61
2002-03	49	38	33	40	0.85	1.48
2003-04	43	50	46	58	0.76	1.19
2004-05	61	39	64	36	0.84	1.26
2005-06	44	41	56	59	0.69	1.15
2006-07	55	45	57	39	0.81	1.26
2007-08	67	33	41	59	0.66	0.73
2008-09	49	53	34	32	0.79	0.62

Table 5. Monthly age and sex composition (%) of ruffed grouse harvested by cooperating hunters during the 2008–09 season. The sample size for these monthly summary statistics were lower than the annual estimates because some samples did not include dates. Therefore, estimates based on the different sample sizes may be slightly different.

Month	Age		Sex		<i>N</i>
	Adult	Juvenile	Male	Female	
October	100	0	71	29	1
November	33	67	75	25	3
December	56	43	55	45	23
January	67	33	63	37	42
February	80	20	70	30	25
Season	67	33	49	51	94

Table 6. Grouse hunting effort in Virginia based on a 2% random survey of licensed hunters.

Year	Total Grouse Hunters	Total Man-Days Hunting	Total Grouse Harvest
1993-94	28,619	146,512	51,800
1994-95	34,156	176,021	68,418
1995-96	29,625	137,277	66,045
1996-97	24,817	113,836	46,519
1997-98	26,738	128,704	51,889
1998-99	24,782	130,293	49,131
1999-00	18,301	93,536	43,591
2001-02	18,911	94,467	40,070
2004-05	14,237	62,666	22,728
2005-06	11,735	48,147	14,061
2006-07	12,043	64,793	20,353
2007-08	11,869	52,050	16,334
2008-09*	13,342	65,390	13,087

2008-09* Preliminary results

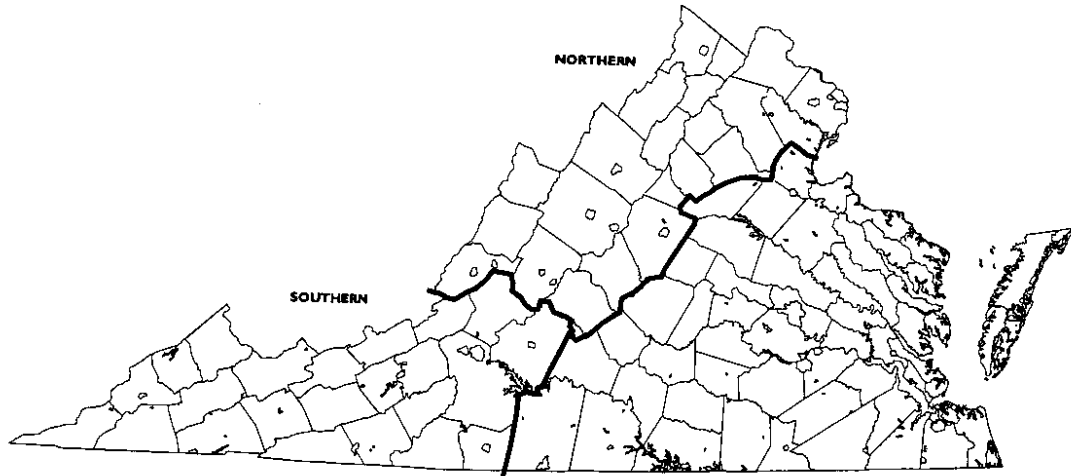


Figure 1. Ruffed grouse regions for fall hunter survey.

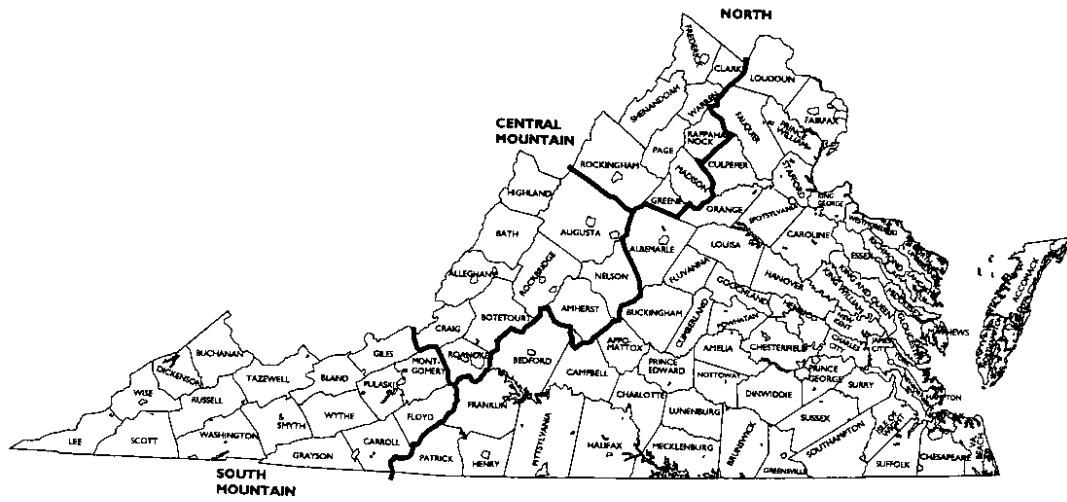


Figure 2. Ruffed grouse regions for spring drumming.

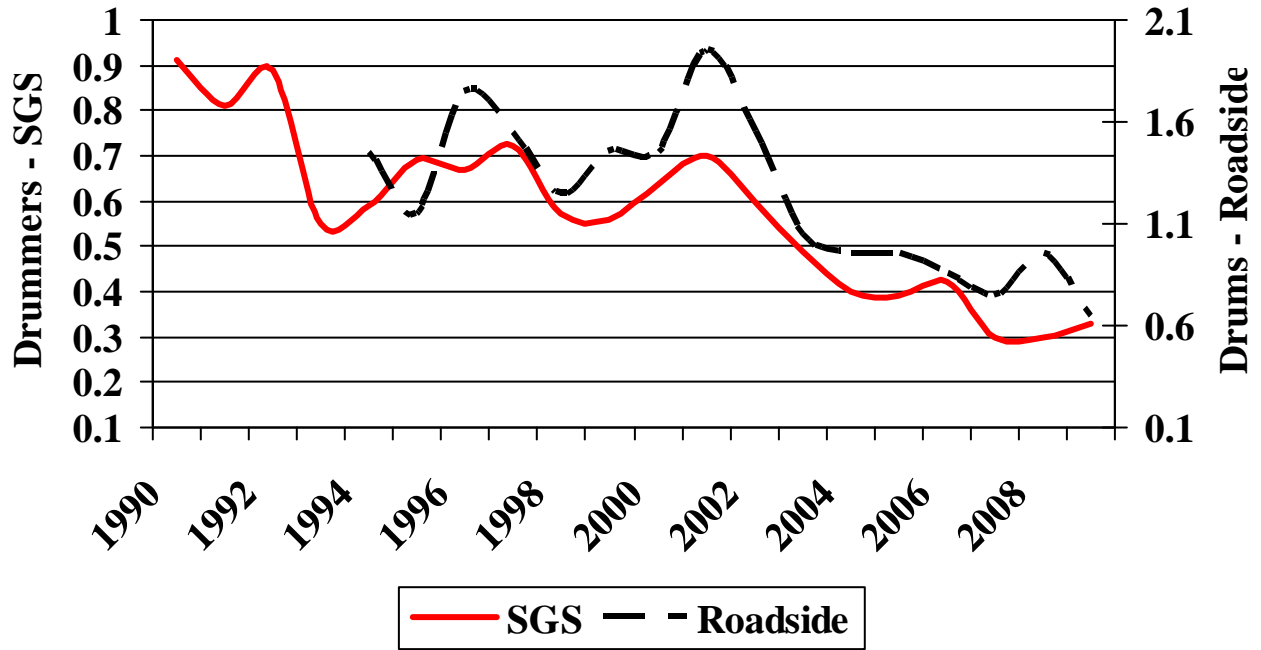


Figure 3. Ruffed grouse drumming rates in Virginia based on roadside surveys (drums/route) and drums heard by cooperating spring gobbler hunters during the first 2-weeks of the spring gobbler season (drums/hunt).

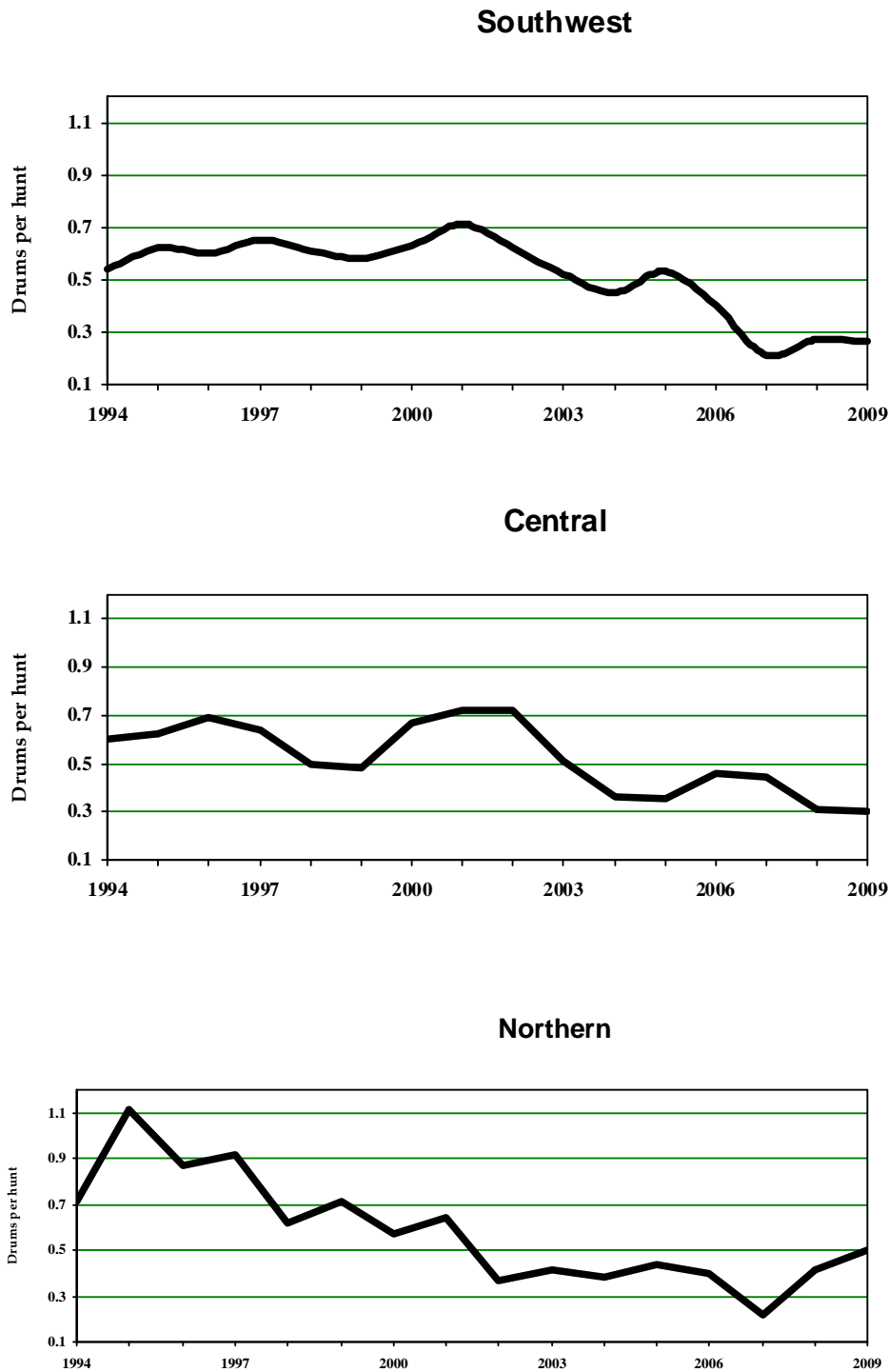


Figure 4. Virginia regional ruffed grouse drumming rates reported by cooperating spring gobbler hunters during the first 2 weeks of the spring gobbler season.

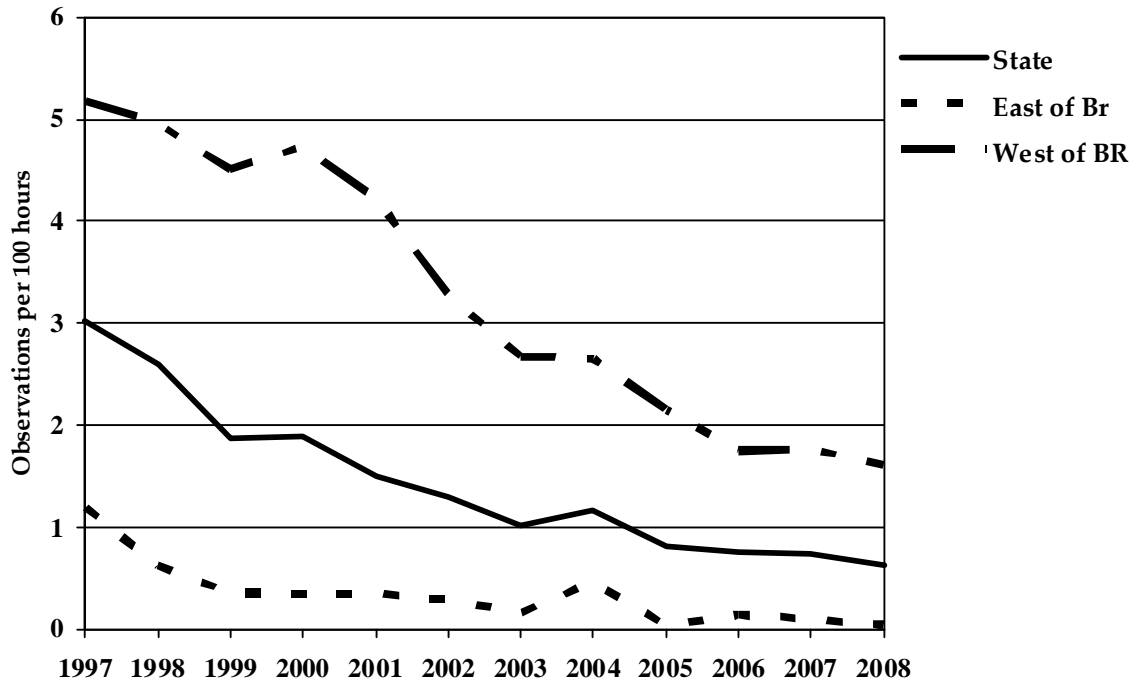


Figure 5. Ruffed grouse observed (per 100 hours of hunting) by cooperating early archery hunters in counties east and west of the Blue Ridge Mountains and statewide in Virginia.

Ruffed Grouse Flush Rates, 1995 - 2008

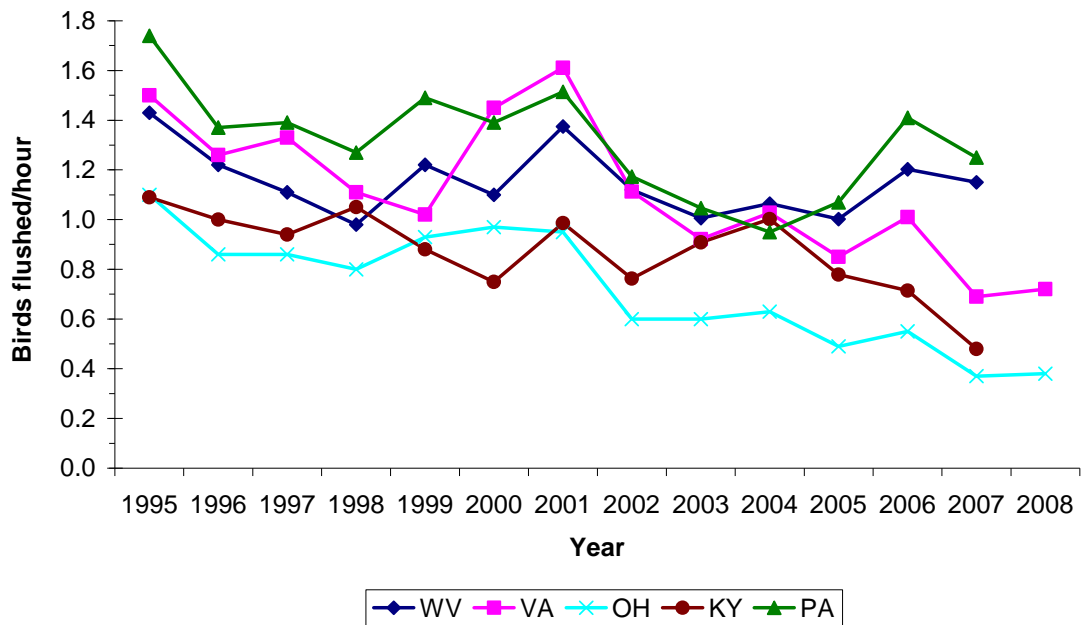


Figure 6. Regional ruffed grouse flushing rates.

Appendix A.

RUFFED GROUSE SURVEY

NAME: _____
 ADDRESS: _____

For further information contact Gary Norman at Virginia Department of Game and Inland Fisheries, P.O. Box 996, Verona, VA 24482 or call 540-248-9389.

INSTRUCTIONS:
 Only one hunter per party needs to complete this form. Count every flush even if you believe it is the same bird. Count flushes whether you see the bird or not. All information regarding hunters and county information will be kept in confidence. Mail survey and feather samples as soon as possible after the season closes.

MONTH - DAY - YEAR	COUNTY	LAND TYPE	HUNTERS IN PARTY	HOURS HUNTED	GROUSE FLUSHED	GROUSE KILLED	HUNT WITH DOGS?	PART QUALITY OF THE HUNT (CHECK)	COMMENTS
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO <input type="checkbox"/>	POOR <input type="checkbox"/> ADEQUATE <input type="checkbox"/> EXCELLENT <input type="checkbox"/>	
							YES <input type="checkbox"/> NO		

Appendix B.

SURVEY INSTRUCTIONS

OBSERVER It is preferable that the same observer run the same route each year. When this is not possible, it is desirable for both observers (old and new) to run the survey together once, so that there is a smooth transition with the new observer becoming thoroughly familiar with survey procedures and local route conditions. Both observers should record their results independently.

DATES For 2001, the first run should be during the week of April 9-13; second run during April 16-20

TIME Begin 30 minutes before sunrise. Sunrise times for April 11, 13, 15, and 17 are listed on each route map. Interpolate sunrise time for dates not listed on the map.

PROCEDURE At stop No. 1 shut off your vehicle's engine, step several feet away and record the time you begin listening. Listen for 4 minutes and count total drums heard. Also determine the number of wild turkeys gobbling and record data. Then proceed rapidly 1 mile to the next stop and repeat the procedure. Continue to do so until all 10 stops have been covered. If a bad traffic hazard prevents stopping within 100 ft. of the 1 mile odometer reading, proceed to the next stop and note "no stop-hazardous" in the space for the stop omitted.

THINGS TO AVOID Do not run routes when the temperature is below 40° F, in heavy precipitation or moderate wind (\geq 8 mph).

REPORTING Immediately after running your route for the second time, mail the forms in the envelopes provided.

ESTIMATING WIND VELOCITY	<u>Velocity (mph)</u>	<u>Suggestions for Estimating Wind Velocity</u>
	Less than 1	Smoke rises vertically
	1 to 3	Direction of wind shown by smoke drift, but not by wind vanes.
	4 to 7	Wind felt on face, leaves rustle, ordinary wind vane moves.
	8 to 12	Leaves and small twigs in constant motion; wind extends light flag.
	13 to 18	Raises dust and loose paper; small branches are moved.

DISTURBANCE	<u>Disturbance</u>	<u>Description</u>	<u>Example</u>
	NO	No appreciable effect on count.	Occasional crow calling.
	LO	Slightly affecting count.	Distant tractor noise.
	MOD	Moderately affecting count.	Intermittent traffic.
	HI	Seriously affecting count.	Heavy-continuous traffic