

2010-11 RUFFED GROUSE POPULATION STATUS IN VIRGINIA

by

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Abstract: Two fall (2010) and two spring (2011) surveys were conducted to monitor ruffed grouse population status in Virginia. Cooperating grouse hunters reported flushing 0.57 birds per hour during the 2010-11 hunting season which is the lowest rate in the survey history. However, results of this survey should be taken cautiously because only 43 hunters contributed data. The long-term (1973-2010) flushing rate was 1.10 birds per hour. In contrast, the average flushing rate over the past 5 years has been 0.74 birds per hour. Grouse hunter satisfaction during the 2010-11 (2.6 on scale of 1-7 with 7 being the highest rating) season was lower than last year (3.0). Trends and flushing rates reported by Virginia grouse hunters are similar to most states in the Mid-Atlantic region in recent years. Bow hunters also saw fewer grouse in 2010 than 2009. The percentage of juvenile birds harvested (50%) by cooperating hunters in 2010 was above the long and short-term averages, although the sample size was low. In contrast to the 2010 fall data, results of population monitoring in the spring of 2011 suggest a more stable population. The spring 2011 breeding population index based on drumming counts from roadside surveys was similar to the 2010 index. Likewise, the number of grouse drumming per hunt by turkey hunters in the spring gobbler season increased slightly. While recent trends in breeding grouse population trends are encouraging in that the population appears to have stabilized, they are nevertheless significantly below historical levels. Trend analyses over the past 15 years suggest significant long-term annual declines in grouse breeding population levels based on drumming indices from roadside surveys (-3.4%) and spring gobbler hunter surveys (-3.4%) in Virginia.

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 8,731 hunters harvested 9,370 grouse during the 2009-10 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 Godfey's very help review of this report

METHODS

Grouse Hunter Survey

A non-random volunteer group of cooperating hunters (cooperators) were included in the 2010-11 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 the 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-retriever 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 23 October 2010 to 12 February 2011. 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 2010. 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):

$$y = ab^x e$$

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 (Bradou and Mundlak 1970) where,

$$b = e^{\frac{\ln(b) - 0.5\text{var}\{\ln(b)\}}{1}}$$

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

RESULTS

2010-11 Fall Population Surveys and Trends

2010-11 Grouse Hunter Survey. Cooperating grouse hunters ($n=43$) reported data from 454 hunts (Table 1). Cooperators averaged hunting 10.6 days and 3.2 hours per hunt. Hunters reported flushing 837 birds while hunting 1,463 hours (Table 2). Flushing rates were slightly higher in January and February (Table 2). Throughout the season hunters averaged flushing 0.57 grouse per hour. Flushing rates over the last 3 years have been low, tied with the previous low rate in the 1976-77 season (Table 3). The long-term average is 1.11 grouse per hour. However, over the past 5 years flushing rates have averaged 0.74 birds per hour. Therefore, current flushing rates are well below the long-term and recent averages. Flushing rates in most states in the Mid-Atlantic region are also showing a downward trend beginning about 2001 (Fig. 6). Pennsylvania is the exception, grouse flushing rates there have stabilized or increased

Cooperators harvested 73 grouse (Table 2) or 1.7 grouse per cooperator last season (Table 1). Little difference in harvest rates (kill/hr) was found among the months of the season (Table 2).

During the 2010-11 season flushing rates in Southern Region (0.66 grouse/hr) were slightly higher than the Northern Region (0.51 grouse/hr; Table 4). Harvest rates were slightly higher in the Southern Region (0.07 harvest/hr) than the Northern Region (0.04). Hunt quality indices were higher in the Northern Region (3.0) compared to the Southern Region (2.4), which is comparable to last year.

Cooperators hunting on private lands reported higher flushing rates (0.67) than cooperators hunting on federal lands (0.59). Hunt quality ratings were similar between (2.9) and federal

lands (2.7). Limited data were available on state lands.

The average quality of hunt rating for cooperating grouse hunters was 2.6 during the 2010-11 season. Hunter satisfaction ratings appear to be declining from a high in the 2001-02 season, although there were some years prior to the 2001-02 season with low ratings (Table 1). Hunt quality ratings were comparable among months of the season (Table 2).

2010 Bowhunter Survey. Bowhunters ($n = 409$) reported seeing 67 grouse on 5,000 bow hunts statewide in the 2010 early archery season. In counties west of the Blue Ridge Mountains, which is the primary grouse range in Virginia, archers reported seeing 0.9 grouse per 100 hours of hunting. This rate is lower than last year (1.7 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).

2010 Reproduction

2010-11 Grouse Hunter Survey. Cooperators submitted 56 usable wings for age and sex determination. Juvenile birds comprised 50% of the sample with a ratio of 2.0 juvenile birds per adult female (Table 3). The percentage of juvenile birds in the fall harvest (50%) was higher 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 2010-11 season as juveniles comprised a significant proportion of the harvest in October. However, the October sample size was low (5). Beyond October, the percentage of juveniles in the harvest was comparable among other months of the season (Table 5). Age ratios were not significantly different by month ($X^2 = 2.89$, $df = 4$, $P = 0.58$). Age ratios were not different between regions ($X^2 = 0.53$, $df = 1$, $P = 0.47$).

Males comprised 55% of the harvest (Table 3). Harvest sex ratios were not different ($X^2 = 1.33$, $df = 4$, $P = 0.86$) by month (Table 5) of the season or

between regions ($X^2 = 0.42$, $df=1$, $P= 0.51$); Table 4).

2011 Spring Population Surveys and Trends

2011 Road Side Drumming Routes. Ninety-six drums were heard during roadside drumming survey routes that were conducted twice during the month of April (44 and 42 routes, respectively). The mean number of drums heard per route was 0.9 (Fig. 3). The rate of drums heard per stop in 2011 was slightly higher than last year (0.8 drums/route). This change may represent a slight increase in the 2011 breeding population. Despite this increase, the roadside survey drumming rate was below the long-term survey (1994-2011) average (1.1 drums/route).

2011 Spring Gobbler Hunter Survey. Cooperating spring gobbler hunters heard 251 drummers and flushed 74 ruffed grouse during 1,018 turkey hunts. This survey took place during the first 2-weeks of the spring gobbler season in Virginia's primary grouse range (Fig. 3). Spring gobbler hunters heard 25 grouse per 100 hunts and flushed 7 birds per 100 hunts (Fig. 3). The 2011 drumming rate was higher than the 2010 survey (23 grouse/100 hunts). However, the rate has dropped very sharply since 2009 when 33 drummers were heard per 100 hunts. High rates were seen in 1991 (90 drums/100 hunts), 1997 (72 drummers per 100 hunts), and 2001 (70 drummers per 100 hunts).

Long-Term Trends. Trend analyses of the roadside drumming data suggest that breeding population levels have declined 3.4% annually over the past 15 years ($P<0.01$). Likewise, trend data (Fig. 3) from the spring gobbler hunter survey suggest 3.4% annual decline over the past 15 years ($P<0.01$).

DISCUSSION AND SUMMARY

Archers cooperating in the Department's Bowhunter Survey saw 0.9 grouse per 100 hours of deer hunting. Similar to the grouse hunters, the rate bowhunters reported seeing grouse was the

lowest on record (Fig 2). Both grouse hunter and bowhunter surveys suggest populations were at very low levels, potentially the lowest levels in the past 20-30 years. Virginia grouse hunters are generally facing similar flushing rates as many other Mid-Atlantic states (Fig. 3).

Some of the disappointing flushing rates cooperators reported may be explained by the abundance of acorn crops. Acorns are an important preferred food source for grouse in the Appalachian region. Birds oftentimes move into areas where they may not ordinarily be expected when acorns are plentiful. Both red and white oak acorn crops were very abundant throughout most of grouse range in Virginia during the 2010-11 season. The availability and distribution of acorns may have dispersed birds throughout the landscape as they foraged in more mature woods. These conditions may have contributed to the low flushing rates reported by grouse hunters and observation rates reported by bowhunters. This situation is somewhat of a double edge sword as acorns provide grouse a critical food resource but the birds become more vulnerable to predation when they leave the cover and protection provided by young forests. Predation rates spike with the migration of woodland hawks in fall and spring.



Another important potential factor that may have affected the low flushing rate was the low number of cooperators. Only 43 hunters participated in the survey, the fewest in the survey history. Low numbers of cooperators could influence estimates as a few cooperators with many hunts may bias the results (high or low).

On an encouraging note, winter survival appeared to be good as the number of drumming grouse heard along Roadside Survey routes increased slightly in 2011. Department and U.S. Forest Service personnel heard 0.9 birds per route compared to 0.8 last year. Spring gobbler hunters also reported hearing more drumming grouse (25 per 100 hunts) than last year (23). So unlike the fall population estimates, spring breeding populations appeared stable between 2010 and 2011 (Fig 1).

Given the similar numbers of spring 2011 drumming grouse compared to 2010, the fall 2010-11 indices may not have been so low because of the abundant acorn crops and/or low cooperator numbers. Even so, avid grouse hunters reported very disappointing comments about the 2010-11 season. Many hunters suggested the season was the worst they have experienced.

There are many factors that influence reproduction. Hen condition and weather are thought to be important variables impacting reproduction. Hens in good physical condition tend to have more chicks that survive until fall. Birds tend to gain more weight and have higher body fat when there is an abundant acorn crop. Given last year's exceptional mast crop, hens going into the 2011 reproductive season offered the promise for good to excellent reproduction. However, cold and wet weather can negate good reproduction as chicks are vulnerable to the stresses weather can bring during April and May.

To assess recruitment, Department staff report brood observations during routine work assignments in August. These observations offer a glimpse of grouse reproductive success. Unfortunately, the observations suggested very poor recruitment in 2011. In grouse range, only 4 grouse broods were seen in August...quite disappointing. We can only surmise that despite apparent good hen physical condition, other factors limited reproduction. Let's hope recruitment is better than our August survey suggests.

Based on long-standing research, biologists believe the number of drumming males in the spring is the best population index. While there is some

consolation in knowing the grouse population has apparently stabilized, grouse populations have experienced a significant long term decline. Over the past 15 years our analyses suggest a 3.4% annual decline in the grouse population to present day low levels. With this population decline we have seen a corresponding decline grouse hunter numbers. Department surveys estimate the number of grouse hunters has declined from 34,156 hunters in the 1994-95 season to 8,731 hunters in the 2009-10 season.

The primary cause of the grouse population decline is believed to be the loss of habitat, specifically young forests. Young forests provide food and cover for grouse throughout the year. Yes, acorns are an important food resource, but without nearby cover to escape predators, grouse populations are challenged to survive and reproduce. Furthermore, acorn production in more mature forests is unpredictable and other foods are not as nutritious. Concerted conservation measures are needed to simply maintain grouse populations at current low levels. Restoration of grouse populations to 2001-02 levels will require even greater efforts to create more early succession habitats. Despite the challenge, creating good grouse habitat is not difficult; however, it takes interest and effort. Grouse are not the only wildlife species in peril that are facing the same management challenge. Natural resource agencies like the Department and the US Forest Service will be challenged to meet these needs and your support of wildlife conservation on public lands will help. Non-governmental agencies like the Ruffed Grouse Society are also vital to grouse conservation. Their mission statement is to "enhance through ecologically sound wildlife management practices, the environment for ruffed grouse, American woodcock, and other forest wildlife that utilize or require thick, young forests."

Compounding the loss of young forests and low grouse numbers is the good fortune Virginia hunters have with an abundance of other game species that offer higher harvest and hunter satisfaction rates. Despite these circumstances, grouse hunting is a beloved sport by many hunters that enjoy working with their dogs and pursuing the King of the Gamebirds with friends and family.

Grouse Book. Following 6 years of intensive research on the ecology and management of Appalachian Ruffed Grouse, project researchers have recently published a book summarizing the major findings of their work in an easy to read format that should provide hunters and managers with a wealth of new information on grouse. The title of the book is Ecology and Management of Appalachian Ruffed Grouse. Anyone interested in ordering the book can contact the publisher, Hancock Press at:
<http://www.hancockhouse.com/products/appruf.htm>.

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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 Qty. 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
2009-10	58	418	7.2	3.2	1.5	0.06	0.72	3.0
2010-11	43	454	10.6	3.2	1.7	0.05	0.57	2.6

Hunt Qty.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 2010-11 season.

Month	Days Hunted	Hours Hunted	Grouse Flushed	Flush/ Hour	Grouse Killed	Kill/ Hour	Hunt Quality ¹
October	50	188	119	0.63	10	0.05	2.7
November	67	231	107	0.46	9	0.04	2.6
December	99	316	159	0.50	13	0.04	2.4
January	152	460	281	0.61	21	0.05	2.7
February	86	270	171	0.63	20	0.07	2.7
Season ²	454	1,463	837	0.57	73	0.05	2.6

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

Season² = Season totals exceeds monthly totals because some hunts without

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
2009-10	72	28	29	0.72
2010-11	55	44	50	0.57
37 Year Average	59	42	41	1.10
Last 5 Year Average	57	43	43	0.74

^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
2009-10	33	67	47	53	0.68	0.77
2010-11	33	67	43	57	0.51	0.66

Table 5. Monthly age and sex composition (%) of ruffed grouse harvested by cooperating hunters during the 2010-11 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> ¹
	Adult	Juvenile	Male	Female	
October	20	80	60	40	5
November	50	50	67	33	6
December	45	56	45	55	11
January	63	38	63	38	16
February	50	50	50	50	18
Season	50	50	55	44	56

*N*¹ Season totals exceed monthly totals because some hunts without dates were included.

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
2009-10	8,731	45,574	9,370

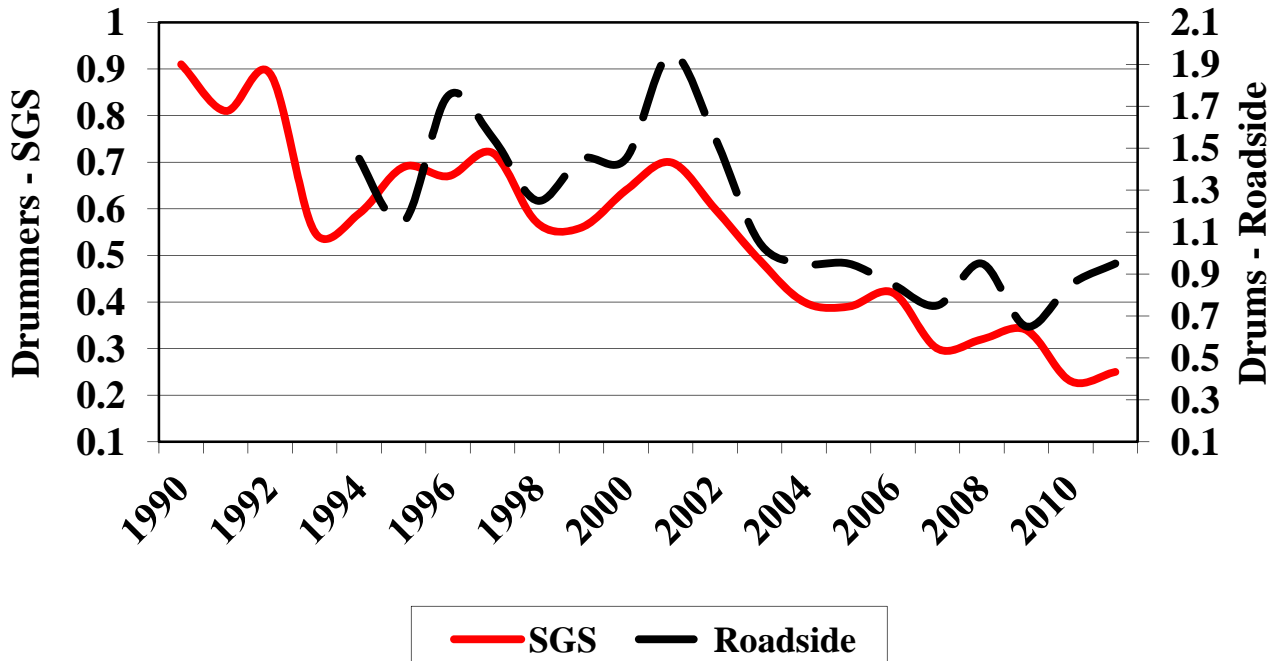


Figure 3. Ruffed grouse drumming rates in Virginia based on roadside surveys (drums/route) and drums heard by cooperating spring gobbler hunters during the first 2-weeks of the spring gobbler season (drums/hunt).

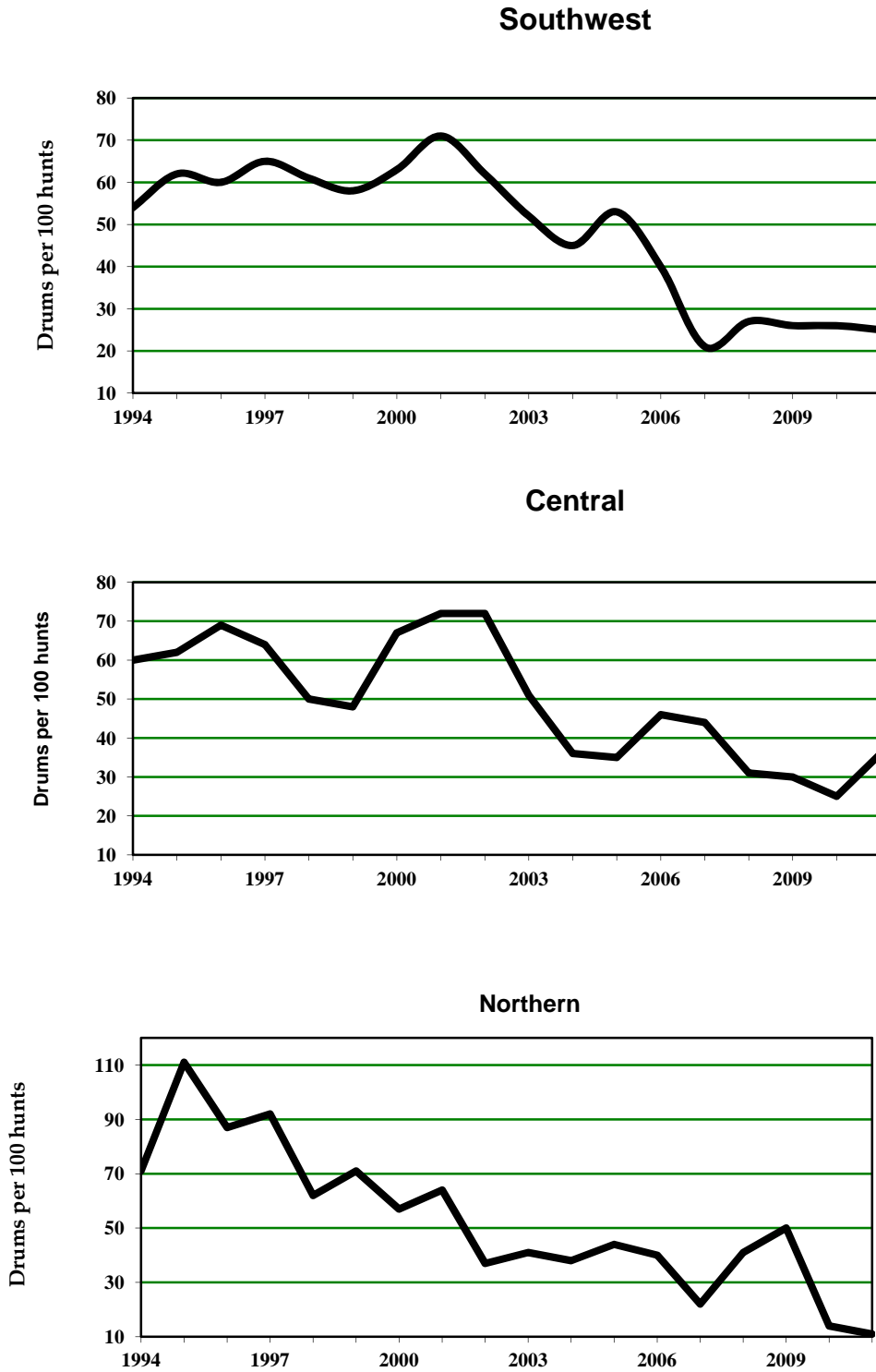


Figure 4. Virginia regional ruffed grouse drumming rates (drums/100 hunts) reported by cooperating spring gobbler hunters during the first 2 weeks of the spring gobbler season.

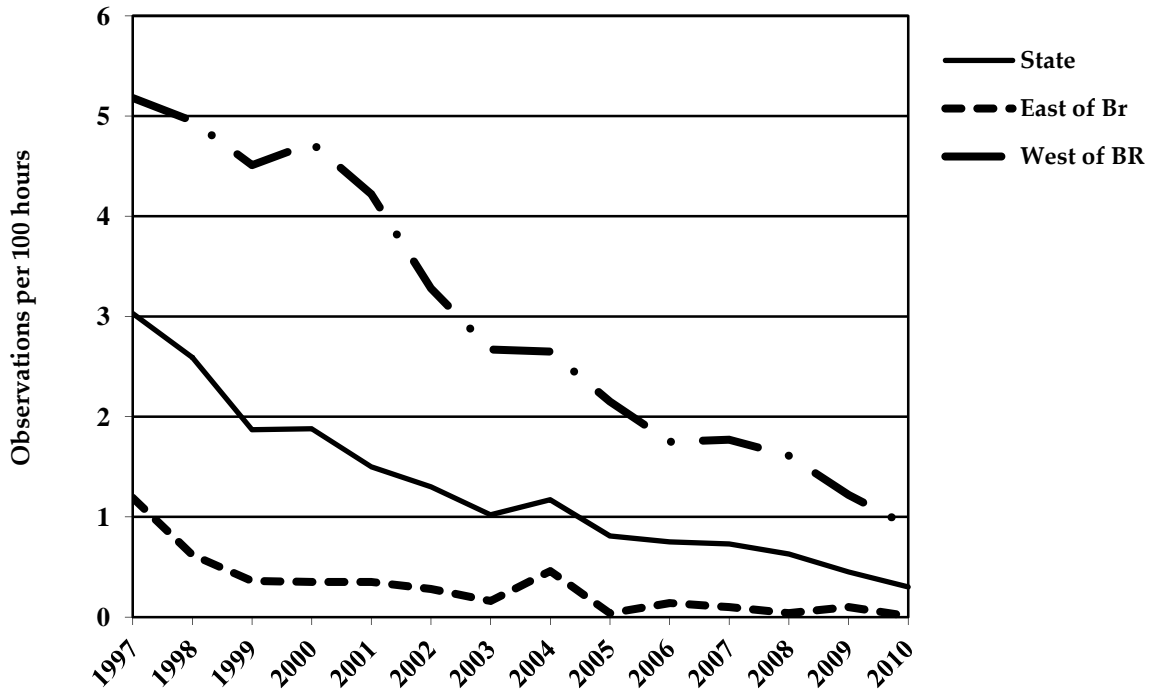


Figure 5. Ruffed grouse observed (per 100 hours of hunting) by cooperating early archery hunters in counties east and west of the Blue Ridge Mountains and statewide in Virginia.

Ruffed Grouse Flush Rates, 1995 - 2010

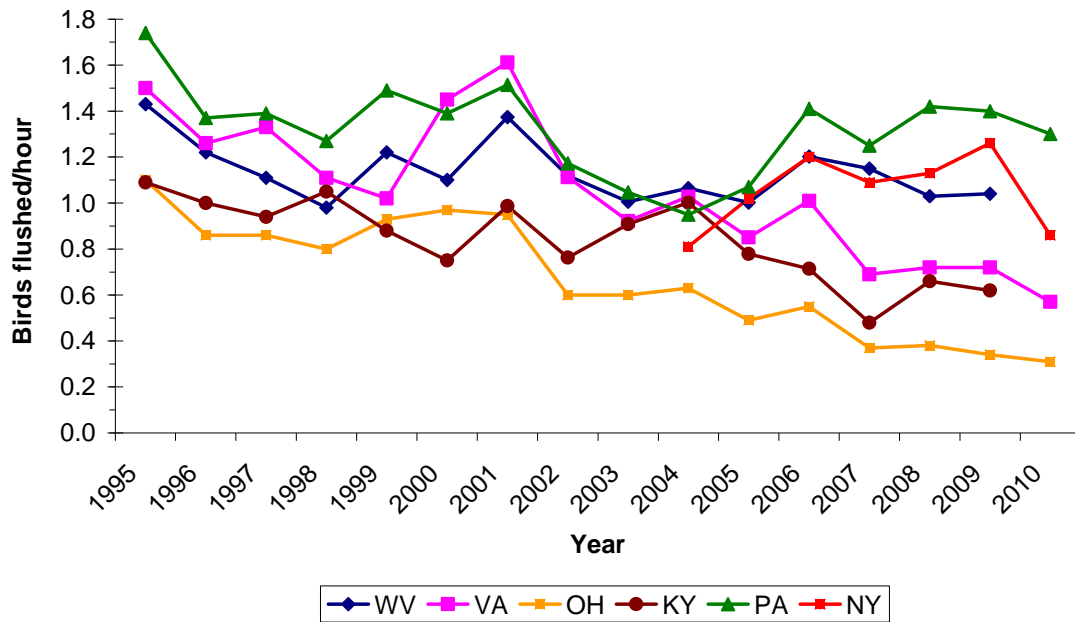


Figure 6. Regional ruffed grouse flushing rates.

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 (≥ 8 mph).
- REPORTING** Immediately after running your route for the second time, mail the forms in the envelopes provided.

ESTIMATING WIND VELOCITY	Velocity (mph)	Suggestions for Estimating Wind Velocity
	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	Disturbance	Description	Example
	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