Ruffed grouse and sharp-tailed grouse surveys in Minnesota during spring 2005

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Abstract

Drum count surveys for ruffed grouse and count surveys of sharp-tailed grouse at dancing grounds were conducted during April and May 2005. Mean counts of ruffed grouse drums throughout the forested regions of Minnesota were 0.8 (95% confidence interval = 0.7–0.9) drums/stop (dps), which was the same as during 2004. Drum counts by survey zone were 1.2 (0.9–1.5) dps in the Northwest, 0.8 (0.6–1.0) dps in the North Central, 0.5 (0.3–0.6) dps in the Northeast, 0.6 (0.4–0.8) dps in the Central Hardwoods, and 0.7 (0.3–1.1) dps in the Southeast. Mean drum counts were also calculated for 7 sections of the Ecological Classification System (ECS). Index values by zone and by ECS section were all essentially the same as they were during 2004.

During the spring 2005 survey 1,824 sharp-tailed grouse were observed at 193 dancing grounds. The mean number of sharp-tailed grouse per dancing ground was 7.6 (6.3–8.9) in the East Central range, 11.4 (9.6–13.2) in the Northwest range, and 9.5 (8.3–10.6) statewide. Means were also calculated for re-defined ranges based on aggregations of ECS sections. The mean number of birds per dancing ground during 2005 was not different than during 2004 for dancing grounds where birds were counted during both years. The difference statewide was -0.6 (-1.4–0.3) birds per dancing ground, or -6 (-13–3)%.

Introduction

Index Surveys

The purpose of surveys of grouse populations in Minnesota is to monitor changes in the densities of grouse over time. Estimates of density, however, are difficult and expensive to obtain. Simple counts of animals, on the other hand, are convenient and, assuming that changes in density are the major source of variation in counts among years, they can provide a reasonable index to long-term trends in populations. Other factors, such as weather and habitat conditions, observer ability, and grouse behavior, vary over time and also affect simple counts of animals. These other factors make it difficult to make inferences about potential changes in wildlife populations over short periods of time (e.g., a few annual surveys) or from small changes in index values. Over longer periods of time or when changes in index values are large, assumptions upon which grouse surveys in Minnesota depend are more likely to be valid, thereby making inferences about grouse populations more valid. For example, index values from the ruffed grouse drumming count survey have documented what is believed to be true periodic fluctuations in ruffed grouse densities (i.e., the 10-year cycle).

Ruffed Grouse

The ruffed grouse (*Bonasa umbellus*) is Minnesota's most popular game bird. It occurs throughout the forested regions of the state. Annual harvest varies from approximately 150,000 to 1.4 million birds and averages >500,000 birds. Information derived from spring drumming counts and hunter harvest statistics indicates that ruffed grouse populations fluctuate cyclically at intervals of approximately 10 years.

During spring there is a peak in the drumming behavior of male ruffed grouse. Ruffed grouse drum to communicate to other grouse the location of their territory. The purpose is to attract females for breeding

and deter encroachment by competing males. Drumming makes male ruffed grouse much easier to detect, so counts of drumming males is a convenient basis for surveys to monitor changes in the densities of ruffed grouse. Ruffed grouse were first surveyed in Minnesota during the mid-1930s. Spring drumming counts have been conducted annually since the establishment of the first survey routes in 1949.

Sharp-tailed Grouse

Sharp-tailed grouse (*Tympanuchus phasianellus*) in Minnesota occur in brushlands, which often form transition zones between forests and grasslands. Sharp-tailed grouse are considered a valuable indicator of the availability and quality of brushlands for wildlife. Although sharp-tailed grouse habitat was more widely distributed in Minnesota during the early- and mid-1900s, the range of sharp-tailed grouse is now limited to areas in the Northwest (NW) and East Central (EC) portions of the state. The NW range consists primarily of Roseau, Marshall, Beltrami, Lake of the Woods, and Koochiching counties. The EC range consists primarily of Pine, Aitkin, Carlton, and St. Louis counties. Since 1990 annual harvest of sharp-tailed grouse by hunters has varied from 8,000 to 30,000 birds, and the number of hunters has varied from 6,000 to 13,000.

During spring male sharp-tailed grouse gather at dancing grounds, or leks, in grassy areas where they defend small territories and make displays to attract females for breeding. Surveys of sharp-tailed grouse populations are based on counts of males at dancing grounds. The first surveys of sharp-tailed grouse in Minnesota were conducted between the early 1940s and 1960. The current sharp-tailed grouse survey was initiated in 1976.

Methods

Ruffed Grouse

Roadside routes consisting of 10 semipermanent stops approximately 1.6 km (1 mile) apart have been established. Routes were originally located along roads with little automobile traffic that were also near apparent ruffed grouse habitat. Therefore, route locations were not selected according to a statistically valid spatial sampling design, which means that data collected along routes is not necessarily representative of the larger areas (e.g., counties, regions) in which routes occur. Approximately 50 routes were established by the mid-1950s, and approximately 70 more were established during the late-1970s and early-1980s.

Observers from the Department of Natural Resources (DNR) Area Wildlife Offices and a variety of other organizations drove along each survey route once just after sunrise during April or May. Observers were not trained but often were experienced with the survey. At each designated stop along the route the observer listened for 4 minutes and recorded the number of ruffed grouse drums (not necessarily the number of individual grouse) he or she heard. Attempts were made to conduct surveys on days near the peak of drumming activity that had little wind and no precipitation.

The survey index value was the number of drums heard during each stop along a route. The mean number of drums/stop (dps) was calculated for each of the 5 ruffed grouse survey zones, each of 7 sections of the Ecological Classification System (ECS) in Minnesota, and for the entire state (Figure 1). As an intermediate step, the mean number of dps was calculated for each route. Mean index values for survey zones and ECS sections were calculated as the mean of route-level means for all routes occurring within the zone or section. Some routes crossed boundaries of ECS sections, so data from those routes were included in the means for both sections. The number of routes within zones and sections was not proportional to any meaningful characteristic of zones or sections. Therefore, the statewide mean index value was calculated as the weighted mean of index values for the ECS sections. The weight for each

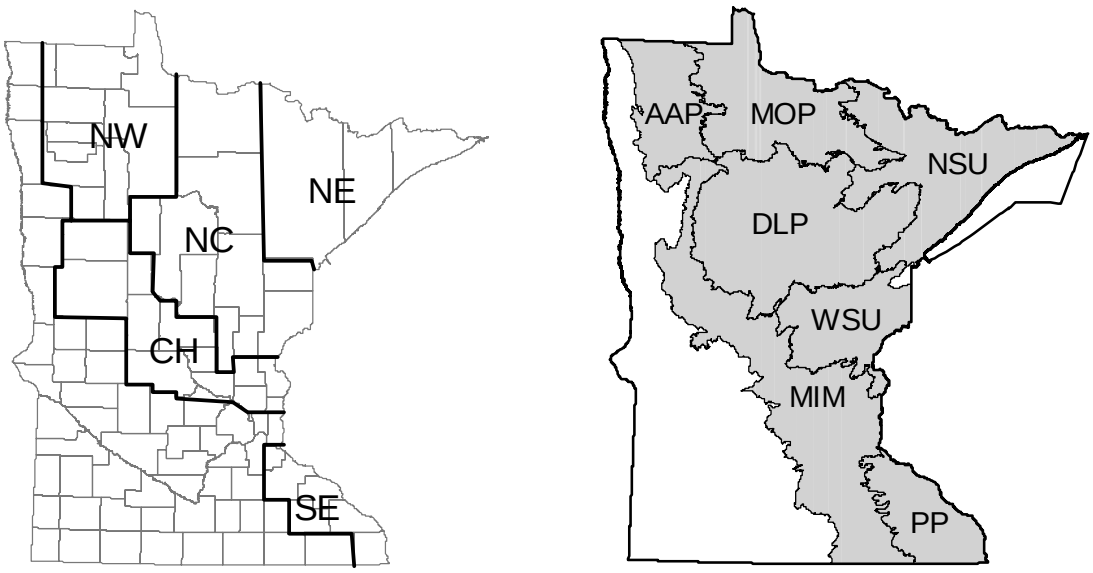

Figure 1. Ruffed grouse survey zones overlaid on county boundaries (left panel) and forested Sections of the Ecological Classification System (right panel) in Minnesota. Zones: NW = Northwest, NC = North Central, NE = Northeast, CH = Central Hardwoods, and SE = Southeast. ECS Sections: AAP = Lake Agassiz & Aspen Parklands, MOP = Northern Minnesota & Ontario Peatlands, NSU = Northern Superior Uplands, DLP = Northern Minnesota Drift & Lake Plains, WSU = Western Superior Uplands (including a small portion of the Southern Superior Uplands in eastern Carlton County), MIM = Minnesota and Northeast Iowa Morainal (only the northern half of which is surveyed for ruffed grouse), and PP = Paleozoic Plateau.

section mean was the geographic area of the section (i.e., AAP = 11,761 km^2, MOP = 21,468 km^2, NSU = 24,160 km^2, DLP = 33,955 km^2, WSU = 14,158 km^2, MIM = 20,886 km^2, and PP = 5,212 km^2; see Figure 1 caption for full section names). Only approximately half of the Minnesota and Northeast Iowa Morainal section and Paleozoic Plateau section were within the ruffed grouse range, so the area used to weight drum index means for those sections was reduced accordingly.

Stops along survey routes are a small sample of all possible stops within the range of ruffed grouse in Minnesota. Survey index values based on the sample of stops are not the same as they would be if drum counts were conducted at a different sample of stops or at all possible stops. To account for the uncertainty in index values because they are based on a sample, I calculated 95% confidence intervals (CI) for each mean. A 95% confidence interval is a numerical range in which 95% of similarly estimated intervals (i.e., from different hypothetical samples) would contain the true, unknown mean. I used 10,000 bootstrap samples of route-level means to estimate percentile confidence intervals for mean index values for survey zones, ECS sections, and the whole state.

I calculated mean index values and CIs for 1982–2005. Data from earlier years were not analyzed because they have not been entered into an electronic database. Annual index values for 1949–1981 are available in the DNR's 2004 Grouse and Hares report.

Sharp-tailed Grouse

Over time, DNR Wildlife Managers have recorded the locations of sharp-tailed grouse dancing grounds in their work areas. As new dancing grounds were located, they were added to the survey list. Known and accessible dancing grounds were surveyed by Wildlife Managers and their volunteers between sunrise and 2.5 hours after sunrise during April to count sharp-tailed grouse. When possible, surveys were conducted when the sky was clear and the wind was <16 km/hr (10 mph). Attempts were made to conduct surveys on >1 day to account for variation in the attendance of male grouse at the dancing ground. Survey data consist of the maximum of daily counts of sharp-tailed grouse at each dancing ground.

The dancing grounds included in the survey were not selected according to a statistically valid spatial sampling design. Therefore, data collected during the survey was not necessarily representative of the larger areas (e.g., counties, regions) in which the dancing grounds occur. It was believed, however, that most dancing grounds within each work area were included in the sample, thereby minimizing the limitations caused by the sampling design.

The index value of interest was the mean number of sharp-tailed grouse per dancing ground, averaged across dancing grounds within the NW and EC ranges and statewide. I calculated range and statewide means for all dancing grounds surveyed during 2004 and all dancing grounds surveyed during 2005. It was not valid to compare the full survey data and results from different years because survey effort and success in detecting and observing sharp-tailed grouse was different between years and the survey samples were not necessarily representative of other dancing grounds. To estimate differences in sharp-tailed grouse index values between years, therefore, I analyzed separately a set of data that included counts of birds only from dancing grounds that were successfully surveyed during both years. Although the dancing grounds in the separate data set were considered comparable, the counts of birds at the dancing grounds still were not. Many factors can affect the number of birds counted, so inferences based upon comparisons of survey data between years are tenuous. I used the separate data set to calculate the difference in the mean number of birds counted per dancing ground between 2004 and 2005 and the percent difference in the total number of birds counted on the comparable dancing grounds.

To account for the uncertainty in index values because they are based on a sample of dancing grounds rather than all dancing grounds, I calculated 95% confidence intervals (CI) for each mean. I used 10,000 bootstrap samples of dancing ground counts to estimate percentile confidence intervals for mean index values for the NW and EC ranges and the whole state.

I used 2 different definitions, or classifications, of range boundaries to summarize the sharp-tailed grouse survey results (Figure 2). I referred to the NW and EC ranges, as they were defined in the past for previous DNR Grouse and Hare reports, as the “former” classification. I defined “new” ranges by reclassifying the DNR’s International Falls wildlife work area and the northwestern portion of the Tower wildlife work area to be in the NW range (formerly, they were included in the EC range). The Eveleth (i.e., southern) portion of the Tower area remained in the EC range under the new classification. The new range delineation was based on ECS section boundaries (Figure 1), with the NW range consisting of the Lake Agassiz & Aspen Parklands and Northern Minnesota & Ontario Peatlands sections and the EC range consisting of portions of the Northern Minnesota Drift & Lake Plains, Western Superior Uplands, and Southern Superior Uplands sections.

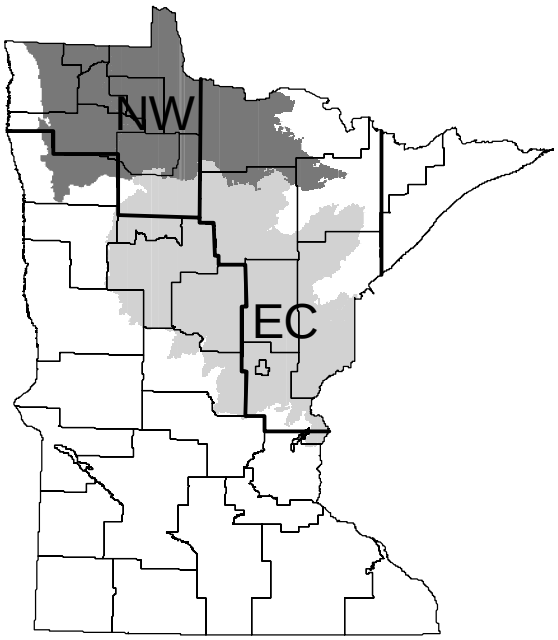

Figure 2. Northwest (NW) and East Central (EC) ranges of sharp-tailed grouse in Minnesota. The heavy lines, based largely on DNR Wildlife Work Area boundaries (light lines), represent the former range boundaries. The dark and light gray shading represent the new range boundaries, based on ECS section boundaries (see Figure 1 for ECS labels).

Results

Ruffed Grouse

Observers from 22 cooperating organizations surveyed 124 routes between 14 April and 23 May 2005. Most routes (82%) were run between 20 April and 10 May. The cooperators included the DNR Division of Fisheries & Wildlife; Chippewa and Superior National Forests (USDA Forest Service); 1854 Authority; Fond du Lac, Grand Portage, Leech Lake, Red Lake, and White Earth Reservations; Agassiz and Tamarac National Wildlife Refuges (U.S. Fish & Wildlife Service); Central Lakes College and Vermilion Community College; Beltrami and Cass County Land Departments; UPM Blandin Paper Mill; and Gull Lake Recreation Area (U.S. Army Corps of Engineers). Observers reported survey conditions as Excellent, Good, and Fair on 48%, 39%, and 12% of routes, respectively. Survey conditions were similar during 2004.

Median index values for bootstrap samples were within 0.03 drums/stop (dps) of the 120 survey means by zone and 0.06 dps of the 168 survey means by ECS section for all annual estimates since 1982. Furthermore, bootstrap medians were within 0.02 dps of 89% of the survey means by ECS section. Therefore, no bias-correction was necessary, and CI limits were defined as the 2.5^{th} and 97.5^{th} percentiles of the bootstrap frequency distribution.

Mean counts of ruffed grouse drums throughout the forested regions of Minnesota were 0.8 (95% CI = 0.7–0.9) drums/stop (dps) during 2005. The statewide drum index has remained unchanged since 2002 at a level similar to the last time the ruffed grouse population was at a low point in its cycle (i.e., 1992–1994; Figure 3). Drum counts during 2005 in the 5 survey zones (Table 1, Figures 1 & 4–8) and the 7 ECS sections (Table 2, Figures 1 & 8–14) were all essentially the same as they were during 2004 (i.e., the CIs overlap considerably).

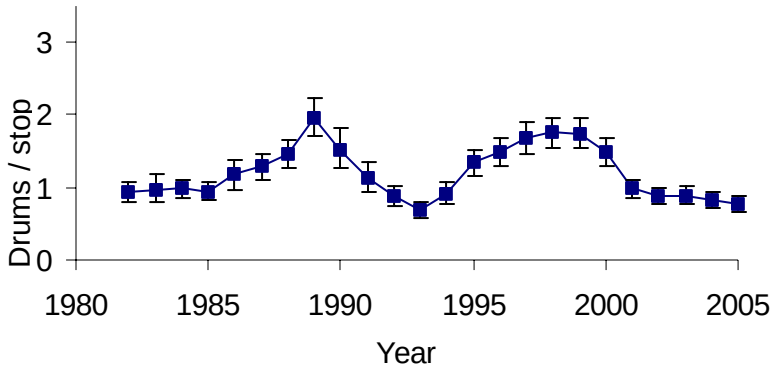

Figure 3. **Statewide** ruffed grouse drum count index values in Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples.

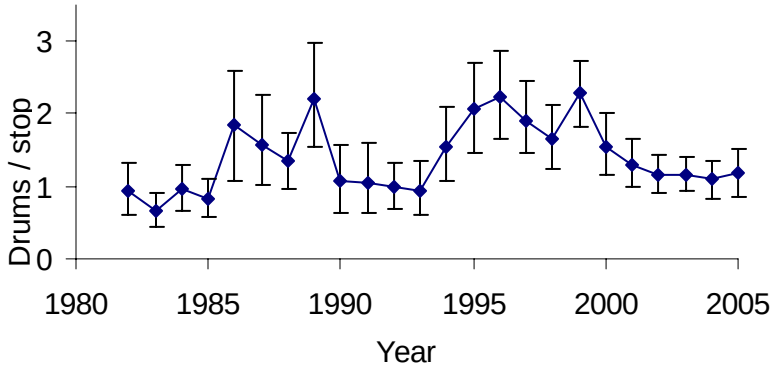

Figure 4. Ruffed grouse drum count index values in the **Northwest** survey zone of Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples.

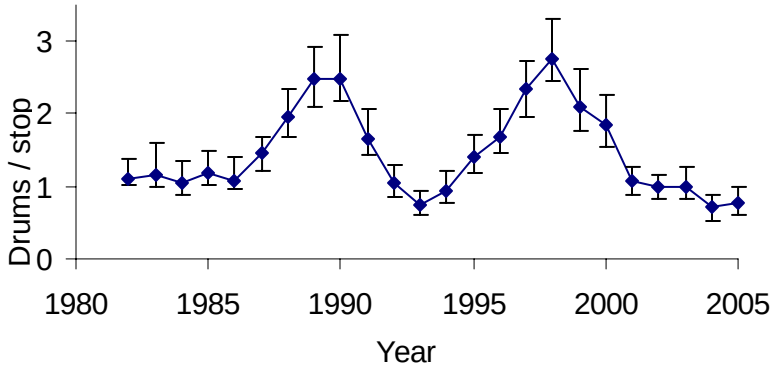

Figure 5. Ruffed grouse drum count index values in the **North Central** survey zone of Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples.

Table 1. Ruffed grouse survey index values (drums/stop) by survey zone in Minnesota during the springs of 2004 and 2005.

	NW[a]		NC		NE		CH		SE	
Year	Mean	95% CI[b]	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
2004	1.1	0.8-1.4	0.7	0.5-0.9	0.6	0.5-0.9	0.7	0.5-1.1	0.7	0.3-1.1
2005	1.2	0.9-1.5	0.8	0.6-1.0	0.5	0.3-0.6	0.6	0.4-0.8	0.7	0.3-1.1

[a] NW = North West, NC = North Central, NE = North East, CH = Central Hardwoods, SE = South East, as defined by county boundaries.

[b] 95% CI = 95% confidence interval for the mean. It is an estimate of the uncertainty in the value of the mean.

Table 2. Ruffed grouse survey index values (drums/stop) by ECS Section[a] in Minnesota during the springs of 2004 and 2005.

	AAP[b]		MOP		NSU		DLP		WSU		MIM	
Year	Mean	95% CI[c]	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
2004	0.8	0.5-1.0	1.4	1.1-1.7	0.6	0.4-0.8	0.7	0.6-0.9	0.8	0.5-1.1	0.7	0.4-1.1
2005	0.9	0.6-1.2	1.4	1.0-1.9	0.5	0.4-0.7	0.8	0.6-1.0	0.6	0.4-0.7	0.6	0.3-0.8

[a] ECS = Ecological Classification System.

[b] AAP = Lake Agassiz & Aspen Parklands, MOP = Northern Minnesota & Ontario Peatlands, NSU = Northern Superior Uplands, DLP = Northern Minnesota Drift & Lake Plains, WSU = Western Superior Uplands, and MIM = Minnesota and Northeast Iowa Morainal. The Paleozoic Plateau is the same area as the Southeast Zone (see Table).

[c] 95% CI = 95% confidence interval for the mean. It is an estimate of the uncertainty in the value of the mean.

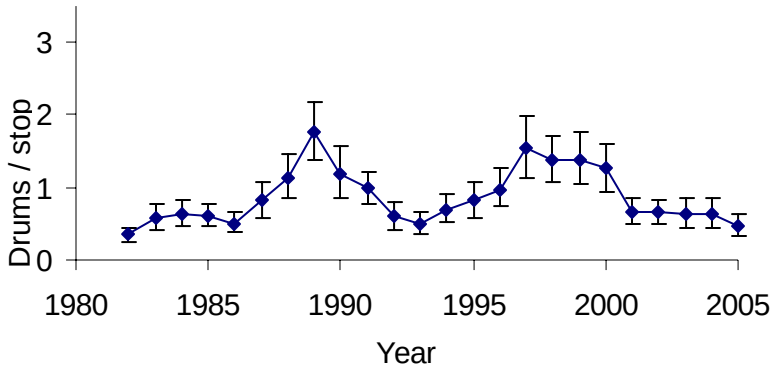

Figure 6. Ruffed grouse drum count index values in the **Northeast** survey zone of Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples.

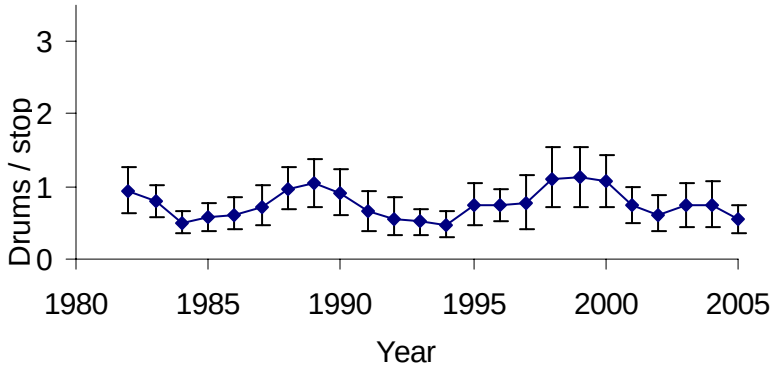

Figure 7. Ruffed grouse drum count index values in the **Central Hardwoods** survey zone of Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples.

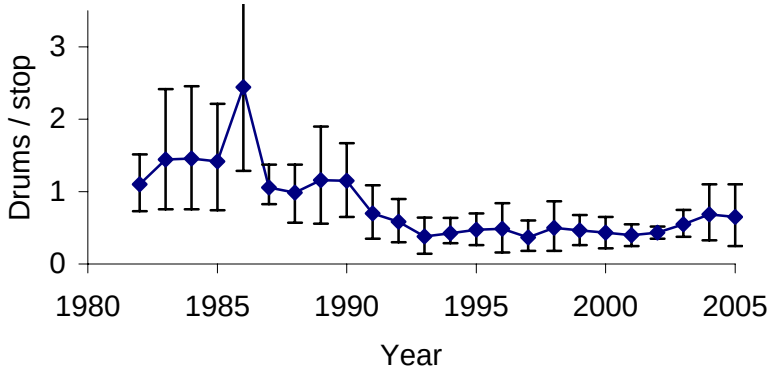

Figure 8. Ruffed grouse drum count index values in the **Southeast** survey zone of Minnesota. This represents the same area as the **Paleozoic Plateau** ECS section. Vertical error bars represent 95% confidence intervals based on bootstrap samples. The y-axis truncated 1 error bar so the scale would be identical for Figures 3–14.

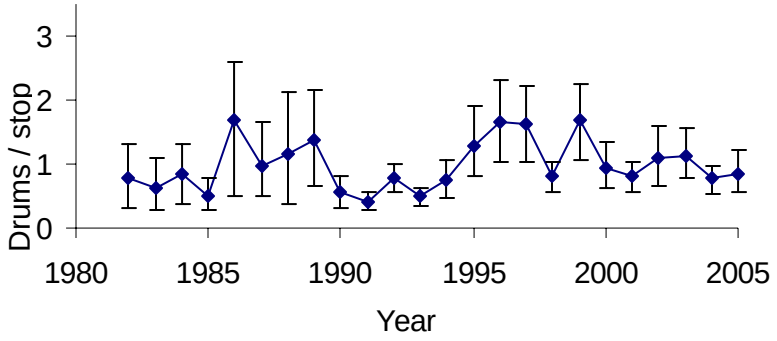

Figure 9. Ruffed grouse drum count index values in the **Lake Agassiz and Aspen Parklands** ECS section of Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples.

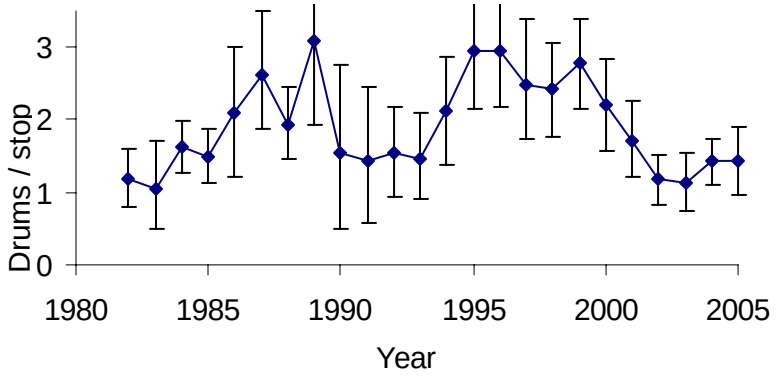

Figure 10. Ruffed grouse drum count index values in the **Northern Minnesota & Ontario Peatlands** ECS section of Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples. The y-axis truncated 3 error bars so the scale would be identical for Figures 3–14.

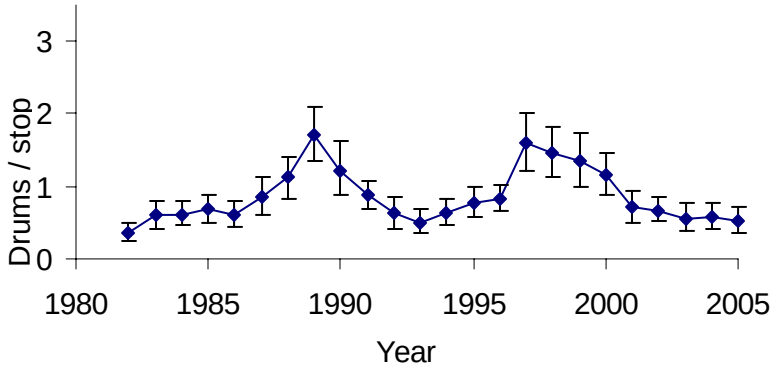

Figure 11. Ruffed grouse drum count index values in the **Northern Superior Uplands** ECS section of Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples.

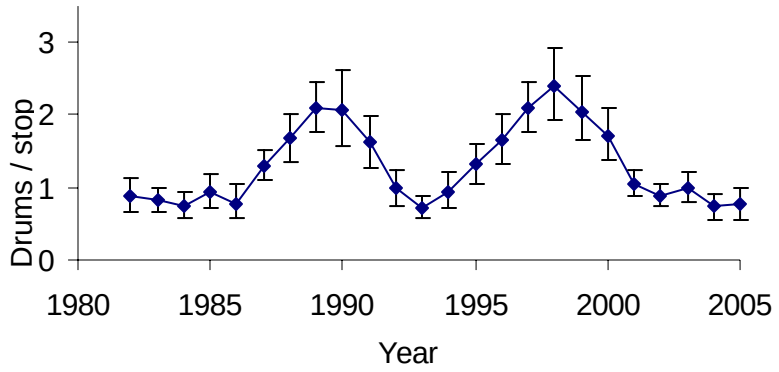

Figure 12. Ruffed grouse drum count index values in the **Northern Minnesota Drift & Lake Plains** ECS section of Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples.

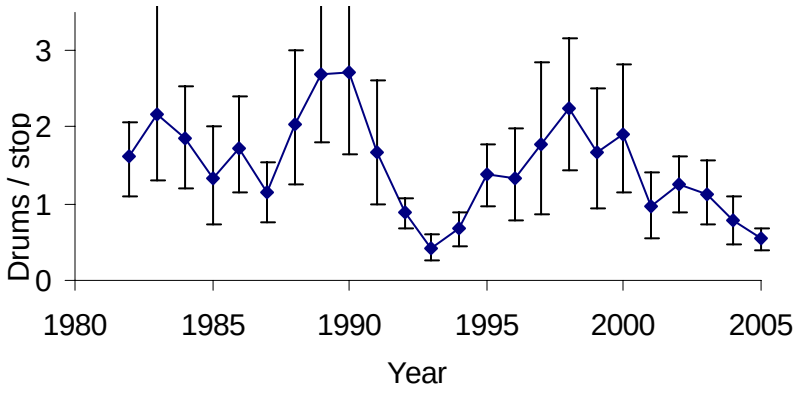

Figure 13. Ruffed grouse drum count index values in the **Western Superior Uplands** ECS section of Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples. The y-axis truncated 3 error bars so the scale would be identical for Figures 3–14.

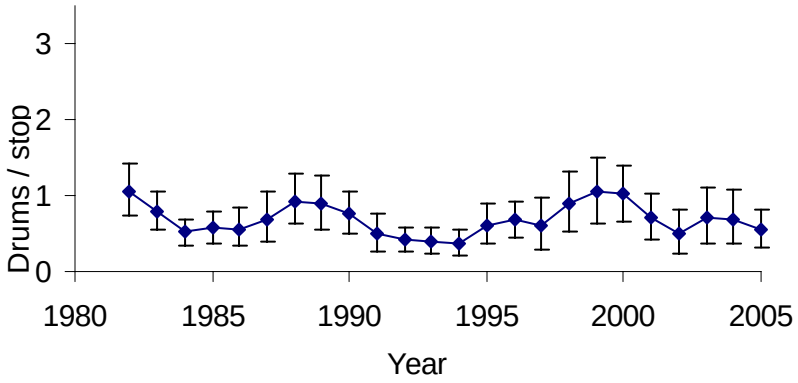

Figure 14. Ruffed grouse drum count index values in the **Minnesota and Northeast Iowa Morainal** ECS section of Minnesota. Vertical error bars represent 95% confidence intervals based on bootstrap samples.

Sharp-tailed Grouse

A total of 1,824 sharp-tailed grouse was observed at 193 dancing grounds during spring 2005 (Table 3). The number of sharp-tailed grouse counted per dancing ground in the EC range was lower than in the NW range, and the statewide mean was 9.5 (95% CI = 8.3–10.6) grouse counted per dancing ground (Table 4). The mean number of birds counted per dancing ground during 2005 was not different than during 2004 for the 182 dancing grounds where birds were counted during both years (i.e., all CIs contained 0; Tables 3 & 5).

Table 3. Number of sharp-tailed grouse dancing grounds observed during 2005 surveys and during both 2004 and 2005 surveys.

		Former[a]		New	
	Statewide	EC[b]	NW	EC	NW
2005 only	193	100	93	78	115
2004 & 2005	182	94	88	76	106

[a] See Methods for definitions of "former" and "new" range boundaries.
[b] EC = East Central, NW = Northwest.

Discussion

Ruffed Grouse

Based upon the drum count index ruffed grouse densities during spring 2005 were likely very similar to spring densities during 2002–2004. Index values during low periods of the population cycle are often <0.9 drums/stop (dps), so drum counts during recent years are not unusual. Although 2005 was the 4th or 5th year of an apparent low period in the population cycle, similar 4- to 5-year periods of relatively low drum counts have occurred as recently as the early-1980s. The number of ruffed grouse encountered by hunters and other outdoors people this fall likely will depend nearly as much upon recruitment of juveniles as on densities of males during spring.

Sharp-tailed Grouse

Counts of sharp-tailed grouse at dancing grounds in Minnesota during 2005 were very similar to counts during 2004. The slight decline in counts between years in the NW range, given the moderate degree of uncertainty in the estimates, was not sufficient evidence to infer a meaningful change in the abundance of sharp-tailed grouse in northwestern Minnesota. Furthermore, sources of temporal variation that are not related to the abundance of sharp-tailed grouse, such as the timing and duration of surveys, could cause minor changes in bird counts and index values.

Although index values from different years are not necessarily comparable, the mean number of sharp-tailed grouse counted per dancing ground has fluctuated in a pattern consistent with an apparent long-term population cycle similar to that of ruffed grouse. During the last 20 years values of the sharp-tailed grouse index have been between approximately 7 and 11 birds counted per dancing ground. This year's statewide mean of 9.5 (8.3–10.6) birds counted per dancing ground was in the middle of that range.

Table 4. Number of sharp-tailed grouse counted per dancing ground in Minnesota during spring.

			Former[a]				New			
	Statewide		EC[b]		NW		EC		NW	
Year	Mean	95% CI[c]	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
2004	10.0	9.0–11.1	7.6	6.5–8.8	12.3	10.8–13.9	7.2	5.9–8.5	11.7	10.4–13.1
2005	9.5	8.3–10.6	7.6	6.3–8.9	11.4	9.6–13.2	7.2	5.8–8.7	11.0	9.4–12.6

[a] See Methods for definitions of "former" and "new" range boundaries.
[b] EC = East Central, NW = Northwest.
[c] 95% CI = 95% confidence interval for the mean. It is an estimate of the uncertainty in the value of the mean.

Table 5. Differences in counts of sharp-tailed grouse at comparable dancing grounds during 2004 and 2005 in Minnesota.

			Former[a]				New			
	Statewide		EC[b]		NW		EC		NW	
	Value	95% CI[c]	Value	95% CI	Value	95% CI	Value	95% CI	Value	95% CI
Birds/ground	-0.6	-1.4–0.3	0.1	-0.9–1.1	-1.2	-2.6–0.1	0.0	-1.0–1.0	-0.9	-2.2–0.3
% difference in total birds	-6	-13–3	1	-11–15	-10	-20–1	0	-13–14	-8	-17–3

[a] See Methods for definitions of "former" and "new" range boundaries.
[b] EC = East Central, NW = Northwest.
[c] 95% CI = 95% confidence interval for the value. It is an estimate of the uncertainty in the magnitude of the value.

Acknowledgements

I sincerely appreciate the help of all the DNR staff and volunteer cooperators who conducted the grouse surveys. I also appreciate the efforts of Bill Berg, who coordinated the collection of grouse survey data for many years, and John Erb and others who translated most of the grouse survey data into a digital format.