AN EVALUATION OF WISCONSIN RUFFED GROUSE SURVEYS

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DEPARTMENT OF NATURAL RESOURCES
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ABSTRACT

Seven annual surveys have been conducted during varying portions of a 19-year period (1962-80) which permit assessments of them as relative abundance indexes of ruffed grouse *(Bonasa umbellus)* in Wisconsin. These surveys included the harvest estimate, roadside drumming count transects, winter roost counts, study area censuses of male grouse on areas in northern and central Wisconsin, a spring and a summer rural resident wildlife inquiry, and a grouse brood tally. These have been extensively applied rather than narrowly used except for the study areas.

Survey techniques are described, available data summarized and the data trends compared graphically and by correlation. The highest conformance of survey results occurred in the northern forest range. This suggests greater sensitivity of indexes as compared to the poorer consistency of the more discontinuous southern range. The roadside drumming count and the harvest estimate appear to provide the most consistent indexes of abundance.

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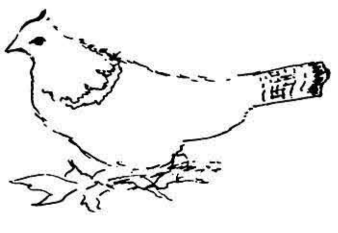

INTRODUCTION

This report attempts to evaluate through simple correlations the ruffed grouse surveys that have recently been in use by the Wisconsin Department of Natural Resources (DNR). Wisconsin has maintained a consistency in annual hunting regulations despite fluctuations in ruffed grouse abundance, in the belief that in most of the range there is little depressant effect of hunting upon grouse populations. Information on populations and harvest provides a means of assessing such strategy.

Seven survey procedures have been in use for a sufficient period (at least 6 years) to permit evaluation. They include harvest estimates, roadside drumming transects, winter roost tallies, study area censuses, rural resident wildlife inquiry (spring and summer), and brood tallies. No attempt is made to estimate annual productivity, survival, or expoitation of ruffed grouse (hereinafter called "grouse") populations. The survey results are treated as simple population indexes applying to the year in which the survey was conducted. Extensive areas of the state in open farmland, particularly eastern and southern Wisconsin, do not support this bird, but no stratification within the regions below was attempted.

Survey data were compared in the northern forest, southern grouse range, and statewide (Fig. 1). The northern forest includes those counties predominantly within the northern deer range (Wisconsin Conservation Department 1962). These counties contain commercially valuable forest throughout, which averages greater than 70% of their land area. The study area census at Stone Lake and the grouse roost count provided data relevant only to the northern forest. The southern grouse range included the remainder of Wisconsin where grouse habitat varies from extensive forests to isolated woodlots, and from steep topography to extended glacial lake basin. The study area census at Sandhill provided data that was matched only with surveys in this southern grouse range.

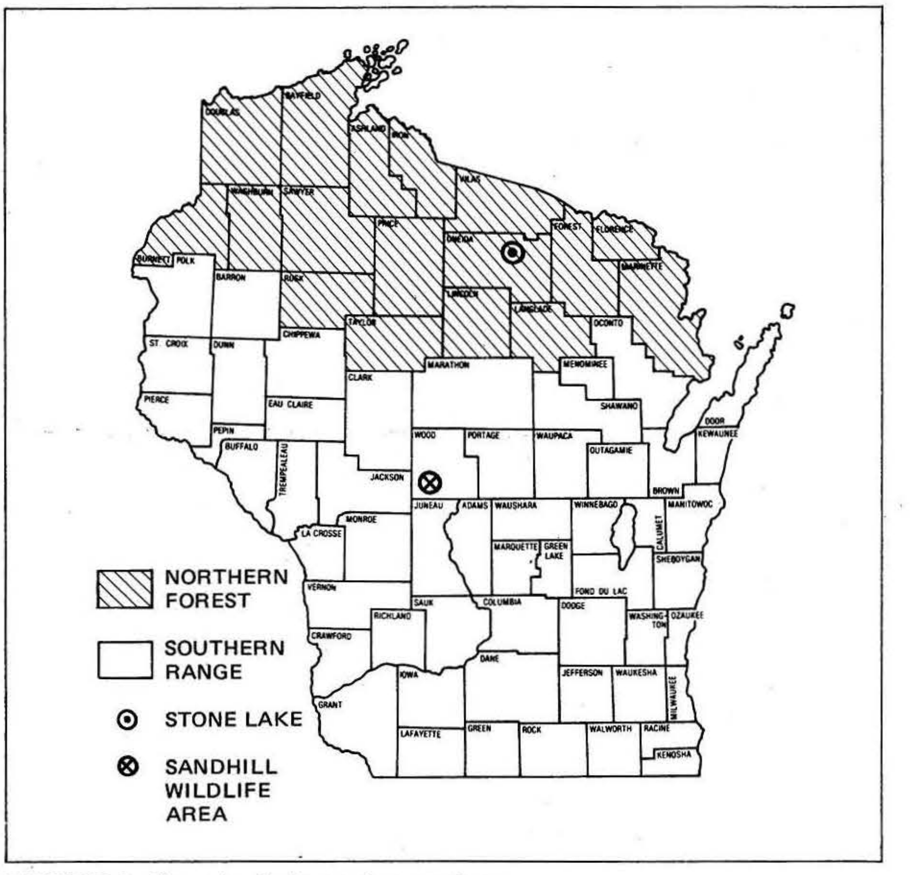

FIGURE 1. *Counties designated as northern forest and southern ruffed grouse range, and locations of two research study areas.*

PROCEDURES

Harvest Estimates

Harvest estimates have been derived from mail surveys since 1931 (except 1976-77) by the DNR Bureau of Wildlife Management. Only estimates since 1962 are used in this evaluation, as earlier estimates were based on a voluntary license stub return. Since 1962, a postseason one-page questionnaire has been mailed annually to a sample of small game licensees of the preceding year (Thompson 1951). The sample is weighted by county sales, and has numbered 10,000 licensees through 1971 and 20,000 since 1972. While not enforced, a statute is cited which requires reports when requested by the Department. The response rate has averaged about 45%. Follow-up mailings have not usually been made. Respondents report the number of ruffed grouse and other small game species bagged by county during the preceding season. In the absence of reasonably uniform or defined correction factors no adjustments were applied for response and nonresponse biases; hence the relation

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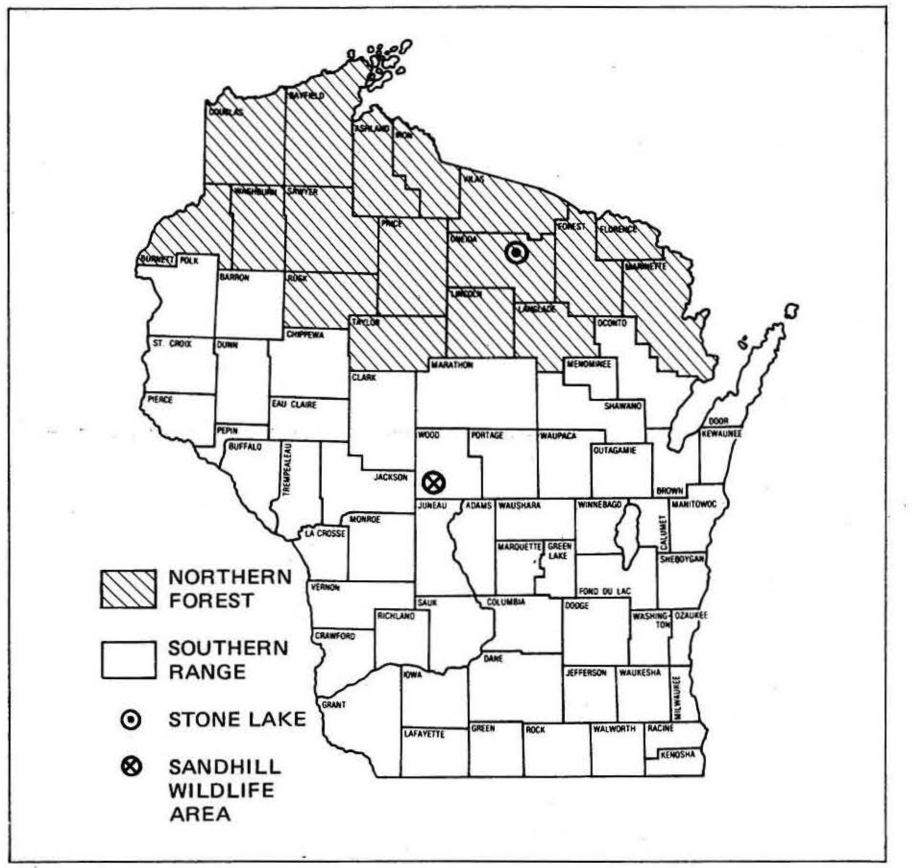

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Ruffed grouse range in the "coulee country" of western and southwestern Wisconsin does not readily lend itself to closely precribed sampling methods. Indexes may help integrate large area observations for trend estimation.

Northern Wisconsin range has fewer discontinuities, but much is remote and undergoes pattern change from wood utilization. Large scale index methods in effect provide larger sampling units, lessening these problems.

to true harvest cannot be stated. Reported kills in the northern counties were aggregated and projected to a total harvest for the northern forest. Harvest in the remainder of the state was calculated similarly. The statewide harvest was calculated by combining and projecting reports from all counties (DNR Wildlife Management Bureau).

Roadside Drumming Count

The roadside drumming count was developed in Minnesota by Petraborg et al. (1953) and modified for use in Wisconsin by Dorney et al. (1958). It was initiated in northern Wisconsin in 1951, but was temporarily discontinued from 1957 through 1961. The survey was reestablished in 1962 and coverage was extended to include the major statewide grouse range. General procedures, advantages and limitations of the roadside drumming survey were also described by Ammann and Ryel (1963) and Rogers (1981). Briefly, most Wisconsin counts are made on 15-mile road transects with drumming birds and number of drummings (drums) heard in 4 minutes recorded at 1 mile intervals. A single observer commences at least 1 hour before local sunrise in late April or early May. Usually two runs are made and the one having the higher number of drums is adopted. Individual bird tallies are distrusted due to the difficulty of distinguishing individual birds in forested areas.

Data from 1962 through 1980 are used in this analysis. Transects were distributed throughout the major grouse range, but neither in a random nor systematic manner. Usually they were placed locally in the higher grade range. Each year 20-40 transects were run, averaging 34. In the northern forest, transects ranged from 12 to 21 in number and averaged 16/year. In the southern region, the number ranged from 12 to 19 and averaged 17. Counties were averaged to obtain 3 annual indexes: statewide, northern forest and southern (DNR Survey Reports: Thompson and Rusch series 1980 and earlier). The Minnesota drumming count data were reported by Chesness (1974) and Berg (Minn. DNR pers. comm.).

Grouse Roost Tally

The number of winter grouse roosts, as described by Dorney (1958), occurring on 1/50-acre plots was tallied from 1955 through 1978 in conjunction with annual deer pellet surveys conducted only in northern Wisconsin (Thompson 1955). Roost data were evaluated since 1962 because that was the first year with comparable data from other grouse surveys. Annually, an average of 16 northern deer management units were sampled from 1962 through 1965. Beginning in 1966, 35 northern units were systematically scheduled on a 3-year rotation (ca. 12/year) until abandonment of these surveys. Grouse roosts/acre were calculated from these surveys to compare the populations in the northern forest.

Study Area Censuses

A minimum estimate of the drumming grouse population was determined annually on each of two study areas since 1968: the Stone Lake Experimental Area (4,202 acres) in Oneida County (Moulton 1975) and a part (2,400 acres) of the Sandhill Wildlife Area in Wood County (Kubisiak 1980) (Fig. 1). These areas are searched at least twice each spring to locate drumming grouse. Only grouse positively identified as established on activity centers are tallied and used in subsequent analyses. The acreage searched each year remains constant, so the number of male grouse can be used as an index for direct comparison with annual indexes from each of the broader surveys.

Wildlife Inquiry — Spring and Summer

Since 1962, questionnaires have been mailed to Wisconsin rural residents by the Technical Services Section requesting whether ruffed grouse and other small game species were seen by the respondent on their "farms". Questionnaires were mailed in May through 1975 (Spring Inquiry) and also in August through 1980 (Summer Inquiry), except 1976. Spring Inquiry results give the percentage of respondents seeing ruffed grouse between the

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previous October and May, and the Summer Inquiry reflects the percentage observing grouse between the previous May and August. Mailings have ranged from 1,800 to 3,900 with approximately a 90% reply rate. This high rate is maintained by purging mailing lists of cooperators missing two consecutive returns. These surveys have been described in DNR Survey Reports (Thompson and Rusch series 1980 and earlier).

10-Week Brood Tally

Brood survey information has been reported as being a valuable index to grouse abundance. In Michigan, Ammann and Ryel (1963) found brood data to be significantly correlated with roadside drumming data. They concluded that a tally of broods seen, especially in relation to an estimate of observer effort, was a good index to grouse abundance.

Detailed brood observations of ruffed grouse were reported by DNR field personnel from 1961 to 1969. However, use of a comprehensive form over a long observation period seemingly discouraged reporting by many field personnel, so a 10-week summer reporting period system was tried in an attempt to achieve greater compliance. This requires reporters to state only the total number of ruffed grouse and pheasant broods seen in each county, and the observers' estimates of percentage of working hours spent in the field. An announcement letter is given to each field employee in early June with a simple record form at the bottom. Broods seen during working hours of the 10-week period between mid-June and late August are to be counted. Broods seen outside of working hours and during special brood surveys are not to be tallied. At the end of the period, a letter with the same tally form is distributed to employees which calls for immediate submitting of the tally. Each report consists of an individual employe record. If a brood is seen while the observer is in the company of other employees, only one person is to report it. This system yields greater participation and a larger number of broods than the earlier formal brood reporting. This system has been used since 1970 and the indexes derived are total number of broods seen and number of broods seen/observer, but only the latter is reported here. (DNR Survey Reports: Thompson and Rusch series, 1980 and earlier).

SURVEY COMPARISONS

Data from surveys are listed in the Appendix, and include some earlier years which were not used in the comparisons but which provide a longer historical record. Plots of the separate surveys for comparable series of years are presented in Figures 2-4 for the three regions studied: northern forest, southern range, and combined statewide. Missing years are marked "NA" (not available) or "Terminated" if the survey has been discontinued.

Simple correlations *(r)* were calculated for matching years for the various surveys. These values, number of years used, and significance level for these pairs are given in Table 1. All the appropriate correlations were calculated, but *r* values are given only when they have less than a probability *(P)* of 0.20 for chance occurrence. Otherwise, only the number of years used is given.

Diagrams capsulating the significant relationships are given in Figure 5, with lines connecting the correlated surveys. In these diagrams, the study area censuses were not included in order to preserve simplicity. The roost tally surveys were made only in the northern forest range.

Surveys still being conducted as of 1980 are underlined.

Northern Forest Range

Most surveys in the northern forest range consistently reflected changes in grouse abundance. Major trends were shown by the data from most of the 7 surveys (Figs. 2-4). The only major inconsistencies seemed to occur in comparisons involving the spring and summer wildlife inquiries. The population low in 1966 was reflected by each

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Reasonable correlation of grouse abundance appeared to be provided through the harvest estimates, the roadside drumming count, winter roost count, and to a surprising degree, the study area census at Stone Lake. Data on broods, while of a shorter time span, also fell into the pattern. Figure 5 shows 13 correlations beyond the 0.20 level, with 11 of these beyond the 0.05 level. These *r* values are given in Table 1.

Southern Range

Grouse surveys carried out in the southern range showed consistency for major fluctuations (Fig. 3). A population peak during 1972 was reported, and surveys suggested a marked decline in grouse abundance from 1972 to 1973 (Fig. 4). Otherwise, trends were dissimilar and patterns of change could not be determined.

Figure 5 reflects the limited correlation between surveys in the southern range detailed in Table 1; harvest and drumming are well correlated, but low or nonsignificant correlations appear among other surveys.

Statewide

Most statewide indexes showed similar trends during years of major grouse fluctuations (Fig. 4). Indexes reflected a peak of grouse abundance about 1972. After 1972, indexes showed declines in grouse abundance which continued for at least two years. Changes were more variable during 1975 and also prior to 1972, although all surveys with data through the 1960's showed the same general trend during that period.

Indexes derived from roadside drumming counts, harvest estimates and brood counts had the higher correlations as shown in Table 1 and Figure 5.

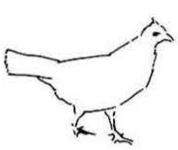


TABLE 1. *Correlation Matrix for ruffed grouse surveys for concurrent periods during 1962-80.*

NORTHERN RANGE

	HARVEST	DRUMS	ROOSTS	STONE LAKE	SPRING INQUIRY	SUMMER INQUIRY
DRUMS	0.76** (16)					
ROOSTS	0.61* (15)	0.90** (17)				
STONE LAKE	0.75* (10)	0.95** (13)	0.87** (11)			
SPRING INQUIRY	0.54* (14)	0.61* (14)	0.54* (14)	-n.s. (8)		
SUMMER INQUIRY	0.47^{S} (15)	0.52* (17)	0.59* (15)	0.59^{S} (11)	0.62* (13)	
BROODS	0.77* (8)	0.71* (11)	0.64^{S} (9)	0.70* (11)	-n.s. (6)	-n.s. (9)

SOUTHERN RANGE

	HARVEST	DRUMS	SANDHILL	SPRING INQUIRY	SUMMER INQUIRY
DRUMS	0.63** (16)				
SANDHILL	0.82* (6)	0.72** (9)			
SPRING INQUIRY	0.71** (14)	0.53^{S} (14)	n.s. (4)		
SUMMER INQUIRY	n.s. (15)	n.s. (17)	n.s. (7)	0.64^{S} (13)	
BROODS	0.54^{S} (8)	n.s. (11)	0.57^{S} (9)	n.s. (6)	n.s. (9)

STATEWIDE

	HARVEST	DRUMS	SPRING INQUIRY	SUMMER INQUIRY
DRUMS	0.79** (16)			
SPRING INQUIRY	0.54* (14)	0.63* (14)		
SUMMER INQUIRY	n.s. (15)	n.s. (17)	0.53* (13)	
BROODS	0.68^{S} (8)	0.62* (11)	n.s. (6)	0.63^{S} (9)

(n) = no. of years compared; d.f. = n-2.
superscripts s = $P < 0.20$
* = $P < 0.05$
** = $P < 0.01$
n.s. = not significant = $P > 0.20$

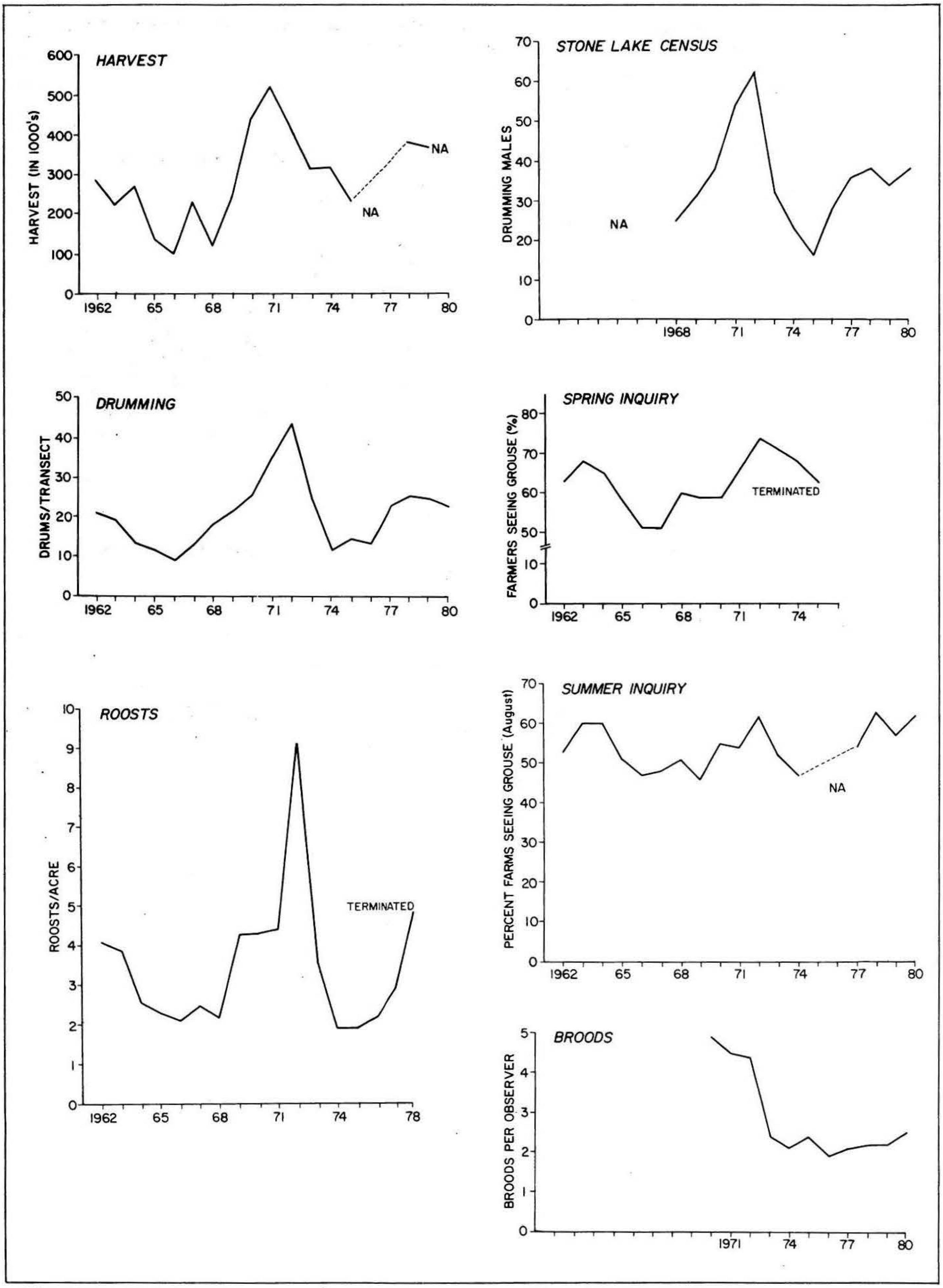


FIGURE 2. *Ruffed grouse survey results on Northern Forest range (1962-80).*

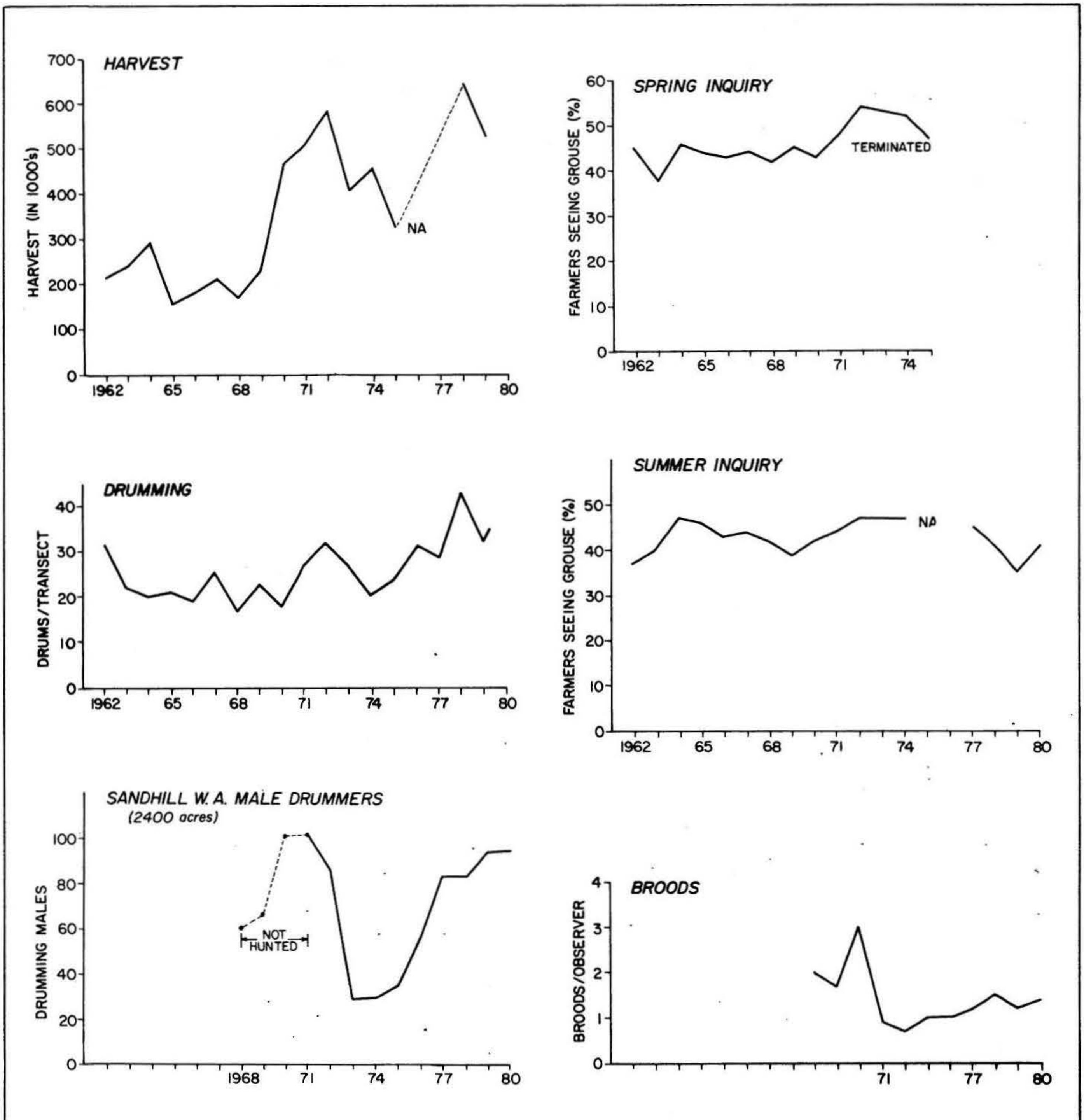


FIGURE 3. *Ruffed Grouse survey results on southern range (1962-80).*

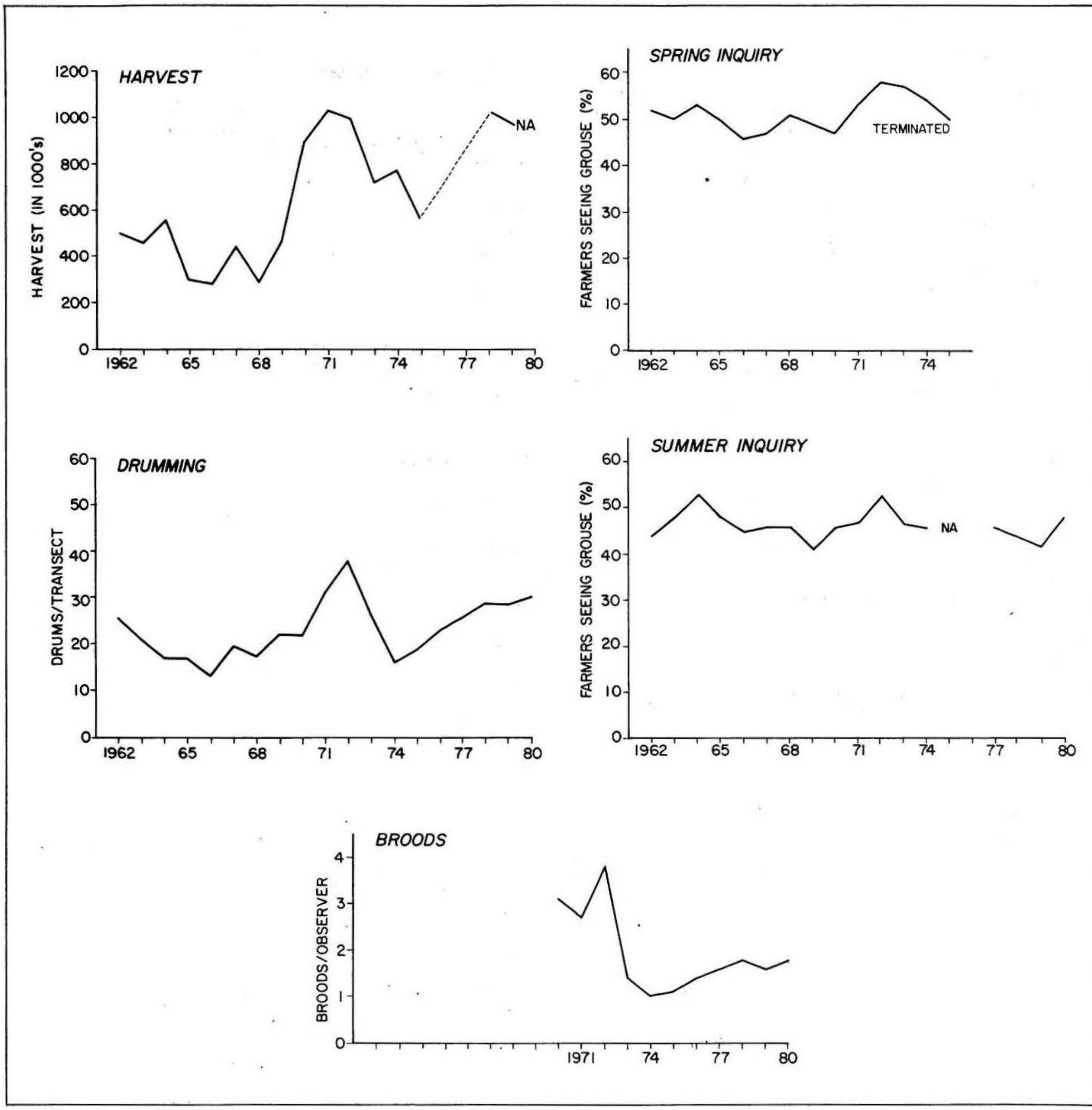


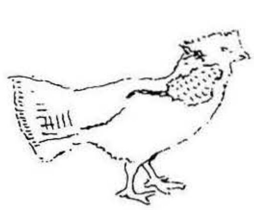
FIGURE 4. *Ruffed Grouse survey results statewide (1962-80).*

Between Ranges

The association of northern forest and southern range drumming counts is shown in Figure 6 for 1962-80. The r value is not strong (0.46), but is significant at $P < 0.05$, 17 df.

Wisconsin and Minnesota

Trends of roadside drumming counts in the northern forest range of Wisconsin and northern Minnesota were also related (Fig. 7). These indexes were highly significantly correlated ($P < 0.01$) at $r = 0.68$, 23 df.



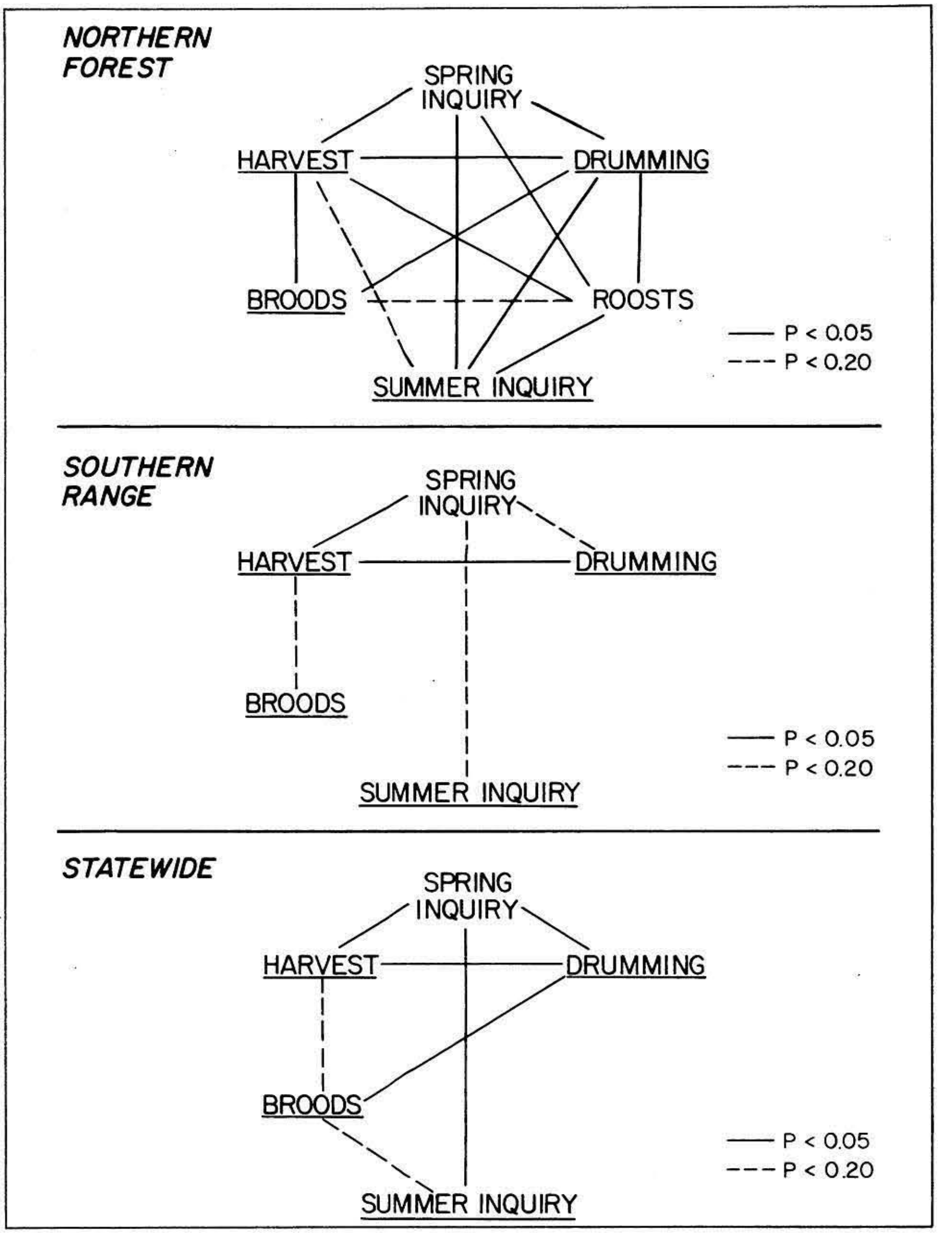


FIGURE 5. *Survey correlations for concurrent surveys during the period 1962-80, in northern forest range, southern range, and statewide. Each comparison includes 6 or more years. Surveys still extant in 1980 are underlined.*

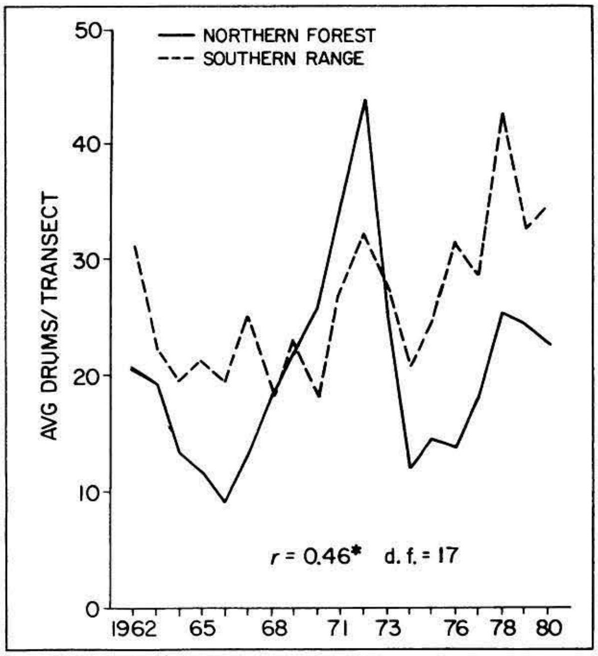


FIGURE 6. *Comparison of drumming counts between northern forest and southern range (1962-80).*

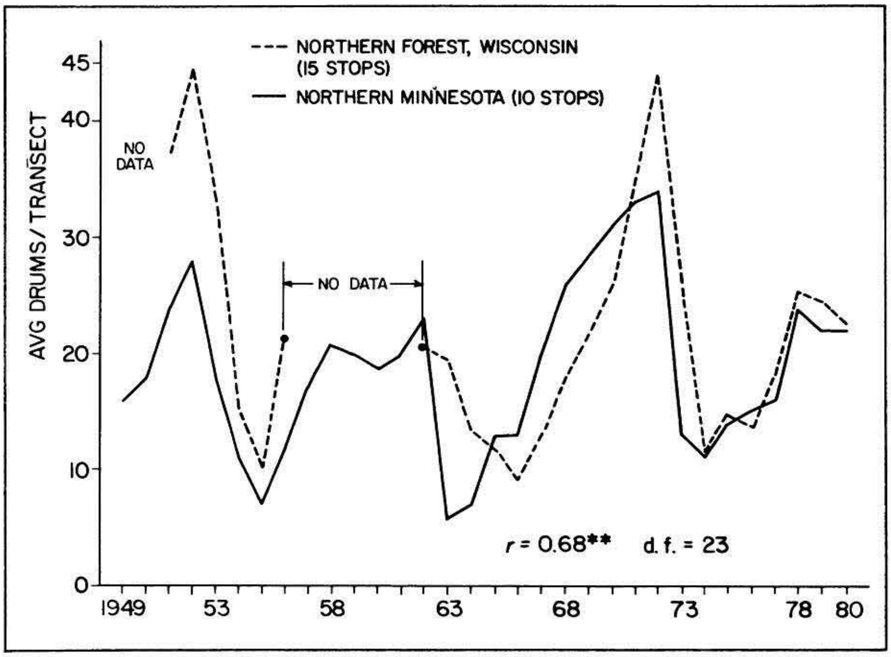


FIGURE 7. *Comparison of drumming counts between northern forest range in Wisconsin and Northern Minnesota (1949-80).*

DISCUSSION

Conformance with other survey trends has been used by several authors as the basis for determining the effectiveness of a survey to estimate grouse abundance. For example, Ammann and Ryel (1963) noted that evaluation of grouse surveys was complicated by the lack of field tests on areas of known grouse populations, by the manner in which index values were obtained, by the probability of chance errors, and by the of lack of randomness of the sample.

They concluded that the only recourse to estimate effectiveness was through comparison of one grouse survey with another using correlation or regression techniques. Dorney et al. (1958) had earlier reported that winter flush counts provided an apparently reliable census technique, since they found a correlation coefficient of 0.96 between flush counts and roadside drumming counts. Gates et al. (1968) compared the results of a new grouse survey with results of established surveys. The authors assumed that the new survey provided a good estimate of grouse numbers since results from all surveys were similar. Gullion (1966) determined that the roadside drumming count provided a rough forecast of the size of the fall population available for hunting, based upon a highly significant correlation between drumming and harvest. Thus, conclusions about grouse abundance have usually been drawn by comparing results among independent surveys.

Limitations of Indexes

Complex analyses seem inappropriate for extensively applied *ad hoc* field techniques of this type. Sampling design must be heavily compromised and few external variables can be controlled. Relation of indexes to true density generally is unknown. In deference to these limitations we do not attempt detailed comparisons of surveys. We accept consistency between surveys as being indicative of a joint value for following major population trends or showing general population level. In the absence of definitive comparative population data, this consistency helps evaluation of individual survey methods.

Obviously a sequential seasonal aspect characterizes our surveys, each following in an annual cycle, but precision is far too low to attempt a seasonal "numbers game".

The temptation exists to attempt prediction through regression analysis, especially harvest estimation, perhaps using multiple regression embracing several surveys. Such efforts even if of low precision may be instructive, but may also be misleading as exemplified by Norton et al. (1961).

Naive methods have rightfully been widely criticized for use in survey work and can be so challenged here. The objections arise primarily in how these are applied and the conclusions drawn from them. It is believed that applied as in Wisconsin the results find some shelter under the umbrella of the well-known and basic Central Limit Theorem. Walker and Lev (1953:143) comment as follows: "... for a wide variety of populations, statistics based on large random samples are distributed normally. This applies to nearly all populations which are likely to be considered in practice..." This statement suggests that our surveys, which, in effect, are aggregations over wide areas of numerous local estimations, should tend to give robust results. Admittedly our sampling is not random and is often poorly distributed, but consistency between years minimizes bias error when results are stated in an index format.

Problems with "Correct" Methods

Sophisticated "correct" methods face the truly stupendous problem of defining a usable sampling frame. Besides basic model assumptions having to be met, population strata or ranges are virtually impossible to realistically delineate for statewide utility. In practice delineation of any boundaries is arbitrary, nonconsistent, and variable both seasonally and over longer periods. Habitat and general land use through the range varies both quantitatively and qualitatively. Topographic features and access avenues for survey purposes further compromise application of closely prescribed field techniques.

These considerations are of high impact at the state level because of the relatively enormous areas involved. Even the simplest possible design using a systematic mile grid, for example, would number over 50,000 points and the path total connecting such points would be about 100,000 miles. Such commitments are vastly beyond reach. This highlights the appeal of exploiting existing field deployment of personnel and also demonstrates the futility of attempting to represent this vast area by a very few local high precision efforts no matter how excellently done.

Leopold (1933:169) stated "In censusing a large area, it is harder to select representative samples than to count the game thereon. Samples ... must be numerous...

Indexes yield a census when the index condition, which is subject to measurement, varies with the population which is not.

Either indexes or samples can be used to determine population trends in time."

Bump, et al. (1947:676) stated "Enough has been said to make it apparent that no one census method applicable to all conditions is to be found."

Evaluation

We recommend simple plotting of survey data from the more consistently performing surveys. Conjectures can then be made on trends rather than attempting to calculate "precise" values. Typically, the gross confidence limits, if calculated would leave one with coarse estimates anyway. Conclusions are most confidently drawn when most indexes reflect a similar change. For example, a northern forest forecast for the 1973-74 hunting season would have been crystal clear. Every index suggested a marked decline in grouse abundance. Wildlife managers could have reported with confidence (and most did), that northern grouse numbers had declined substantially. By the next hunting season (1974-75) managers could have concluded that grouse abundance had further declined and was at a very low level. Survey results were mixed preceding the 1975-76 season. Some indexes indicated a further decline and others indicated a slight increase in grouse numbers. However, it was evident from the trends that grouse numbers were still at a very low level. If an actual increase had occurred, it would probably have been too slight for sportsmen collectively to detect. A forecast for 1975-76 would thus again emphasize a very low population level.

When trends of various surveys disagree greatly, those that have shown the greater consistency may be given greater weight. The roadside drumming index showed the most consistent pattern of change, and agreed most commonly with other survey indexes, particularly harvest estimates. Trends shown by the 10-week brood survey appeared quite similar to the other surveys, except in 1970, which was the first year for this revised brood survey.

Survey trends were markedly more highly correlated in the north than in the southern portion of Wisconsin. Statewide estimates were derived from the aggregation of northern and southern data. Thus, the estimates of grouse abundance were best for the northern forest, second statewide, and poorest for the southern portion of Wisconsin. The better agreement among northern surveys was most likely due to the greater amplitude of grouse fluctuations in the North. Keith (1963) concluded that evidence for greater fluctuations at higher latitudes was widely reported, but inconclusive. He subscribed to Leopold's (1933) theory that fluctuations are greater on large, continuous tracts than on small, dispersed, or discontinuous blocks of habitat. Northern forest habitat in Wisconsin meets both criteria. It occurs at a higher latitude and consists of a much more extensive and continuous habitat than occurs in southern Wisconsin.

A limitation of extensive surveys is that they usually cannot accurately be applied to localized areas due to the greater variation inherently characteristic of small units.

Art of the Possible

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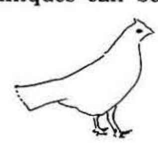

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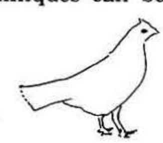

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APPENDIX: Ruffed Grouse Survey Data

NORTHERN FOREST

Year	Drums/Transect	Roosts/Acre	Harvest	Wildlife Inqiury Spring	Wildlife Inqiury Summer	Stone Lake Drumming Males	Broods/Observer
1951	37.6						
1952	44.4						
1953	33.3						
1954	15.9	No	No	No	No	No	No
1955	9.9	Data	Data	Data	Data	Data	Data
1956	21.3						
1957							
1958		4.8					
1959	No	4.2					
1960	Data	3.6					
1961		2.3					
1962	20.6	4.1	287,000	63	53		
1963	19.8	3.9	226,000	68	60		
1964	13.4	2.6	270,000	65	60		
1965	11.7	2.3	140,000	58	51		
1966	9.1	2.1	103,000	51	47		
1967	13.1	2.5	231,000	51	48		
1968	18.1	2.2	121,000	60	51	25	
1969	21.6	4.3	239,000	59	46	31	
1970	25.4	4.3	440,000	59	55	38	4.9
1971	35.1	4.4	522,000	66	54	54	4.5
1972	43.8	9.1	418,000	74	62	62	4.4
1973	25.0	3.6	314,000	71	52	32	2.4
1974	11.3	1.9	318,000	68	47	23	2.1
1975	14.2	1.9	236,000	63	No Data	16	2.4
1976	13.5	2.1	No Data	Terminated	No Data	28	1.9
1977	22.9	2.9	No Data		54	36	2.1
1978	25.3	4.8	381,000		63	38	2.2
1979	24.8	NA	369,000		57	34	2.2
1980	22.6	NA	NA		62	38	2.5

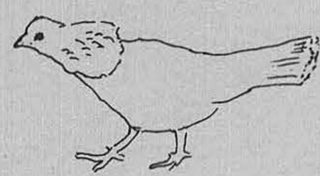
SOUTHERN RANGE

Year	Drums/Transect	Harvest	Wildlife Inquiry Spring	Wildlife Inquiry Summer	Sandhill Drumming Males	Broods/Observer
1962	31.5	216,000	45	37		
1963	22.2	238,000	38	40		
1964	19.9	289,000	46	47	No	No
1965	21.2	157,000	44	46	Data	Data
1966	19.4	183,000	43	43		
1967	25.5	211,000	44	44		
1968	17.3	168,000	42	42	61*	
1969	23.0	211,000	45	39	67*	
1970	18.1	466,000	43	42	101*	2.0
1971	27.0	511,000	48	44	102*	1.7
1972	32.2	578,000	54	47	87	3.0
1973	27.3	405,000	53	47	29	0.9
1974	20.6	455,000	52	47	30	0.7
1975	24.2	326,000	47	No Data	35	1.0
1976	31.3	No Data	Terminated	No Data	56	1.0
1977	28.7	No Data		45	83	1.2
1978	43.2	639,000		41	83	1.5
1979	32.4	525,000		35	94	1.2
1980	34.8	NA		41	95	1.4

*1968-1971 Sandhill W.A. not used in analysis due to closure to hunting.

STATEWIDE

Year	Harvest	Drums/Transect	Wildlife Inquiry Spring	Wildlife Inquiry Summer	Broods/Observer
1931	56,000				
1932	317,000				
1933	318,000				
1934	132,000				
1935	73,000				
1936-37	Closed Season				
1938	81,000				
1939	144,000				
1940	247,000				
1941	353,000				
1942	422,000	No	No	No	No
1943	354,000	Data	Data	Data	Data
1944	115,000				
1945-47	Closed Season				
1948	249,000				
1949	737,000				
1950	799,000				
1951	736,000				
1952	760,000				
1953	814,000				
1954	322,000				
1955	366,000				
1956	645,000				
1957	547,000				
1958	431,000				
1959	323,000				
1960	215,000				
1961	348,000				
1962	503,000	25.6	52	44	
1963	464,000	21.0	50	48	
1964	559,000	17.0	53	53	
1965	296,000	16.9	50	48	
1966	286,000	13.1	46	45	
1967	442,000	19.6	47	46	
1968	289,000	17.7	51	46	
1969	450,000	22.3	49	41	
1970	906,000	21.9	47	46	3.1
1971	1,032,000	31.2	53	47	2.7
1972	996,000	38.1	58	53	3.8
1973	719,000	26.3	57	47	1.4
1974	773,000	16.1	54	46	1.0
1975	568,000	19.1	50	No Data	1.1
1976	NA	23.3		NA	1.4
1977	NA	25.9		46	1.6
1978	1,020,000	34.0	Terminated	44	1.8
1979	894,000	28.8		42	1.6
1980	NA	30.0		48	1.8



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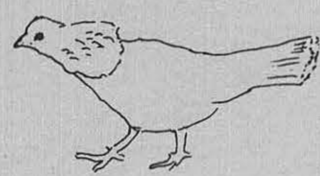

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