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Variation Among Participants in the Count of Calls of Cock Pheasants[1]

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Abstract. Analysis of variance of counts of calls of male ring-necked pheasants (*Phasianus colchicus*) in Iowa revealed highly significant differences among 16 persons on the same 10-station route on the same morning. Differences up to 15 minutes in starting time of observers had no significant effect on counts.

Differences among 16 persons were studied in an analysis of variance of counts of crowing cock pheasants in an area of above-average pheasant population density near Ruthven in northwest Iowa. Participants were senior undergraduate and graduate, fisheries and wildlife biology students in a wildlife techniques class at Iowa State University.

Kimball (1949) listed factors affecting accuracy of pheasant crowing counts, and Heath (1961) identified sources of variation in converting an audio-index into estimated ratios of population abundance. Kozicky (1952), Klonglan and Kozicky (1952), and Nomsen (1953) showed effects of season, time of day, and weather on crowing counts in Iowa. Lyon (1960) reported relationships of crowing counts to weather, time, and type of habitat in Colorado. Variations in frequency of crowing by individual captive cocks were related to season and time of day by Nelson et al. (1962) in Washington. Burger (1966) studied the roles of season, time, and population density on frequency of crowing by Wisconsin pheasants. Also in Wisconsin, Gates (1966) investigated seasonal and daily trends of crowing frequency and effects of sex ratios and population density on crowing frequency.

Variation among observers was recognized by many investigators without attempting to evaluate quantitatively its effect on crowing counts. Carney and Petrides (1957) found that counts by two experienced counters were generally higher and agreed among themselves more frequently than did simultaneous counts by four inexperienced persons in Michigan.

PROCEDURE

On April 25, 1965, a 12-station route was run at five-minute intervals by four observers per car in five cars. Examination of pheasant crowing counts collected that morning suggested for future testing the null hypothesis that no differences existed among counts by different observers over the same route on the same morning. Also, linear regression analysis was planned to test the hypothesis that starting time had no linear effect on number of calls counted.

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The same route was checked on April 30, 1966, by four observers per car in six cars. However, wind above 20 m.p.h. made these data unsuitable for testing the hypotheses.

On April 30, 1967, the route was run again following an extended briefing on the previous day and introduction of the group to the two-syllable call of a cock pheasant. Four cars, each with four observers, departed from station one at five-minute intervals with the first car beginning the count 35 minutes before sunrise. Stations were at mid-section lines one mile apart. Each car ran the same route with exactly five minutes between the start of the count at successive stations. Observers were instructed not to slam doors, not to talk during the two-minute counting period, nor to reveal their counts to other persons until all 12 stations had been run. At each station, four observers simultaneously counted all audible two-syllable calls of cock pheasants. Observers stood at least 10 feet from the car, and the motor was turned off.

All counts from stations 1 and 12 were discarded as had been planned to avoid any effects of possible congregating of observers at the start and end of the route. Thus, the analysis included data from a 10-station route, stations 2 through 11.

Bartlett's test for homogeneity of variance (Snedecor, 1956:285-286) indicated that variances for different observers were proportional to the mean count per station. Therefore, individual counts at each station were transformed using $\sqrt{X + 1}$ (Snedecor, 1956:315). The test for homogeneity of variance then gave a nonsignificant Chi-square of 9.26 with 9 degrees of freedom, which indicated that the transformation was successful. Statistical analysis then proceeded on the transformed data from 1967.

Results

Mean number of calls per station ranged from 1.7 to 6.2 and averaged 3.03 among the 16 observers (Table 1). Subsequent tests of observers' hearing revealed that one, who heard 1.9 calls per station, had loss of hearing above 2,000 cycles/sec. (personal communication from Fred J. Vallier, Assistant Professor of Speech, Iowa State University). Other observers showed no loss of ability to hear sounds at frequencies to 8,000 cycles/sec.

Linear regression analysis of observers' total counts on starting time yielded a nonsignificant t-value of 0.2 with 14 degrees of freedom. Analysis of variance revealed highly significant differences among observers. Differences among stations and the interaction between stations and starting times were also highly significant, but the effect of different starting times was nonsignificant in the analysis of variance (Table 2).

The difference, divided by number of stations, between observer

Table 1

Counts by 16 Observers of Crowing Cock Pheasants on a 10-Station Route near Ruthven, Iowa, April 30, 1967

Car and Starting Time	Observer	Station 2	3	4	5	6	7	8	9	10	11	Total
	1	15	13	3	5	4	4	3	3	0	3	53
I	2	9	18	4	1	2	4	3	1	1	2	45
4:40	3	3	8	1	3	1	2	0	0	0	1	19
	4	8	8	0	0	2	3	0	1	0	1	23
		35	47	8	9	9	13	6	5	1	7	140
	5	8	10	5	4	2	4	1	3	0	0	37
II	6	9	10	3	5	3	3	0	2	0	0	35
4:45	7	9	8	3	2	0	2	0	1	0	0	25
	8	4	8	3	2	2	3	0	1	0	1	24
		30	36	14	13	7	12	1	7	0	1	121
	9	6	10	4	3	1	1	0	1	1	0	27
III	10	4	3	4	1	1	1	1	1	1	0	17
4:50	11	8	10	5	4	1	1	0	2	1	0	32
	12	4	6	4	4	1	1	0	0	0	0	18
		22	28	18	10	4	4	1	4	3	0	94
	13	4	6	4	4	1	1	0	0	0	0	20
IV	14	8	17	7	11	3	6	3	4	2	1	62
4:55	15	5	10	3	4	0	2	0	0	0	0	24
	16	7	10	2	3	0	1	0	0	0	0	23
		24	43	16	22	4	10	3	4	2	1	129
		111	154	56	54	24	39	11	20	6	9	484

Table 2

Analysis of Variance of Transformed Counts of Crowing Pheasants by 16 Observers on a 10-Station Route near Ruthven, Iowa, April 30, 1967

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Square	F-Value	Probability of a Higher Value
Total	159	97.4741			
Stations	9	69.1041	7.6782	31.886	less than 0.001
Starting times	3	1.1686	0.3895	1.618	less than 0.23
Station x times	27	6.5010	0.2408	3.536	less than 0.001
Observers	12	13.3452	1.1121	16.330	less than 0.001
Observers x stations	108	7.3552	0.0681		

mean square and mean square for observers $\times$ stations provided an estimate of variance among observers. The square root of this expressed as a percentage of the mean gave a combined coefficient of variation among observers of 14 percent. Computed for observers in each car (each starting time), this statistic ranged from 8 to 24 percent.

The coefficient of variation for count per station was 18 percent after other components of variance were estimated.

Discussion

Less frequent crowing after sunrise (Kozicky, 1952; Nelson et al., 1962) may have caused a general decrease in counts as the morning proceeded. However, Kimball (1949) stated that intensity of crowing was relatively constant from 40 minutes before until 50 minutes after sunrise. Wind may have been partially responsible for the decrease. Wind increased from near zero at the start of the counts to over 10 m.p.h. at the end. Most investigators have recommended that this technique be used only when wind is less than 8 m.p.h.

Taber (1949) found that cloudy or windy weather resulted in a flattening of the morning curve of frequency of crowing, as well as extending it to the right. This would minimize the effect of delayed starting time, such as up to 15-minute differences between starting times of observers on the overcast morning of this count.

The 18 percent coefficient of variation in number of cock calls heard per counting period per station was based on simultaneous counts by different observers. In other studies this statistic was based on repeated counts by the same observers on different days. Kozicky (1952) reported variation of about the same magnitude as was found here, while Kimball (1949) and Gates (1966) showed less variation. In all cases, the need for replication of counts was apparent.

Heath (1961) described a model for a theoretical audio-index with a Latin square design which permitted calculation of components of variance due to different areas, mornings, and observers. However, the price for controlling variation among observers was that the same observers had to be available on as many mornings as there were routes to check and on a different route each morning. Where manpower, work schedules, and travel limitations preclude such plans to evaluate sources of variation, fixing as many factors as possible can obviously reduce variation of counts. Using the same observers on the same routes in consecutive counts then becomes important.

There is some risk in extending results of this study to a different group of observers or to all observers who participate in similar counts. Evidence is meager (Carney and Petrides, 1957), but it seems reasonable to expect that variation would be least among experienced observers. These 16 persons had little or no experience. However, all were men about 20 to 25 years, majors in fisheries and wildlife biology, with a minimum of two summers of work experience, and probably motivated to strive for accuracy. Homogenous characteristics of the participants may have offset their lack of experience in counting calls of pheasants. This description of variation among observers is the first quantitative estimate reported for this source of variation in a technique commonly used to estimate relative abundance of pheasants. These results indicate the general magnitude of error expected when counts by different observers are compared. Disregarding variation among observers could make the technique grossly insensitive to differences in pheasant population density.

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