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FACTORS AFFECTING WOODCOCK SPRING  
POPULATION INDEXES IN SOUTHERN MICHIGAN

Thesis for the Degree of M. S.  
MICHIGAN STATE UNIVERSITY  
William Hardy Goudy  
1960

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**FACTORS AFFECTING WOODCOCK SPRING POPULATION INDEXES  
IN SOUTHERN MICHIGAN**

**BY**

**William Hardy Goudy**

**AN ABSTRACT**

**Submitted to the School of Graduate Studies of Michigan  
State University of Agriculture and Applied Science  
in partial fulfillment of the requirements  
for the degree of**

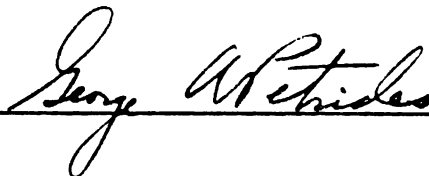
**MASTER OF SCIENCE**

**Department of Fisheries and Wildlife**

**Year**

**1960**

**Approved**

A handwritten signature in cursive script, reading "Gary W. Petrides", is written over a horizontal line.

## ABSTRACT

American woodcock (Philohela minor) spring population-level estimates commonly are determined from roadside counts of males on their singing grounds. This study was undertaken to attempt improvement in the accuracy of these counts.

In 1954, 1955, and 1956, an average of thirty counts were conducted each spring on one or the other of two southern Michigan singing-ground routes. Statistically significant differences were found among many of these counts. The causes of this variation were ascertained by determining (1) the effect of various biological and climatological conditions on woodcock courtship activity, and (2) the factors affecting observers' abilities to hear the singing-ground performance.

As results, the following recommendations were suggested as a basis for standardization in woodcock singing-ground counts in southern Michigan:

1. Counts should be made during the period April 20 - May 10.
2. Counts should be limited to the 30 minutes immediately following the first singing-ground flight.
3. Roadside air temperatures should be above 40° F. at the time of the first singing-ground flight.
4. Wind velocities should be less than 15 miles per hour.
5. When the interference index is 4 (on a scale provided for this purpose) for a single stop or above 2.25 average per stop for the total route, the data for that stop or route should be eliminated from analysis.

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Credit for conceiving the study is due Dr. A. E. Geis, U. S. Fish and Wildlife Service, Laurel, Maryland, while he was a graduate fellow at Michigan State University. Appreciation is expressed to Dr. L. H. Blankenship, Division of Game and Fish, Minnesota Department of Conservation, for guiding and assisting with the field investigations while serving as project leader for Michigan's woodcock investigations. Dr. D. W. Hayne, now of the U. S. Fish and Wildlife Service, Laurel, Maryland, suggested and supervised the statistical work while he was Professor of Zoology at Michigan State University. Much gratitude is expressed to Dr. G. A. Petrides who, on return to Michigan State University from overseas leave, gave advice on the study, edited the manuscript and was instrumental in the completion of the dissertation. Thanks also go to Dr. P. I. Tack, Head of the Department of Fisheries and Wildlife, and Dr. G. J. Wallace, Zoology Department, Michigan State University, for their critical reading of the dissertation. Dr. D. W. Douglass and Mr. R. A. MacMullan served as administrators of the study for the Game Division and Dr. C. T. Black made the facilities at the Rose Lake Wildlife Experiment Station available for the field work.

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**Factors Affecting Woodcock Spring Population Indexes  
in Southern Michigan**

**INTRODUCTION**

Population inventories are important in all game management programs. The only cheap and practical method known for measuring spring population levels of American woodcock, Philohela minor (Gmelin), is the count of males on their singing grounds (Trippensee, 1948).

The courtship performance of the male woodcock occurs both at dawn and at dusk. It consists primarily of ground calls (peents) and flight songs (singing-ground flights), both of which are carried out from grassy openings among shrubs or trees. Such areas are called singing grounds.

The standard inventory method (U.S. Fish and Wildlife Service, 1960) involves traveling by car over selected roads through territory which woodcock inhabit. The length of the route is 3-4 miles, depending upon the local length of period that woodcock actively perform their crepuscular courtship activities. Stops are at least 0.4 mile apart, with a 2-minute listening period at each stop. The observer listens for performing males and records the total number of individual birds heard. The purpose of this type of count is to obtain an index of population abundance under standardized conditions, so that comparisons can be made between routes and years to determine trends in the breeding population. No attempt is made to determine total population size.

Research on woodcock breeding habits has resulted in various modifications of the basic method for conducting singing-ground counts (Aldrich, 1954, 1955, 1956, 1957 and Robbins, 1958). The present study was undertaken in hopes of further improving the accuracy of woodcock counts. The objectives were to test the present standard method in southern Michigan and to determine the optimum conditions under which counts should be conducted. In an effort to accomplish the objectives, it was necessary to determine (1) whether fluctuations occurred in the number of woodcock heard different evenings on the same route, (2) the effects of various biological and climatological conditions on woodcock courtship activity, and (3) the factors affecting observers' abilities to hear the singing-ground performances.

In 1954, 1955, and 1956, about thirty counts were conducted each spring on one or the other of two study routes. The standard method was followed, except that counts were made as many evenings as possible throughout the breeding season, regardless of climatic conditions.

## STUDY AREAS

Michigan apparently leads all other states in the annual legal hunting-kill of woodcock (Blankenship, 1957). Migration data (Glasgow, 1957) and breeding range distribution maps (Mendall and Aldous, 1943) indicate that Michigan produces the majority of the woodcock killed within its boundaries.

Two study areas were used, both located in the central section of southern Michigan (Figure 1). The Chandler Marsh area, five miles northeast (T5N, R2W) of Lansing, in southeastern Clinton County, was studied in 1954. In 1955 and 1956, singing-ground counts were conducted six miles further east, at the Rose Lake Wildlife Experiment Station (T5N, R1E and R1W) in Clinton and Shiawassee Counties.

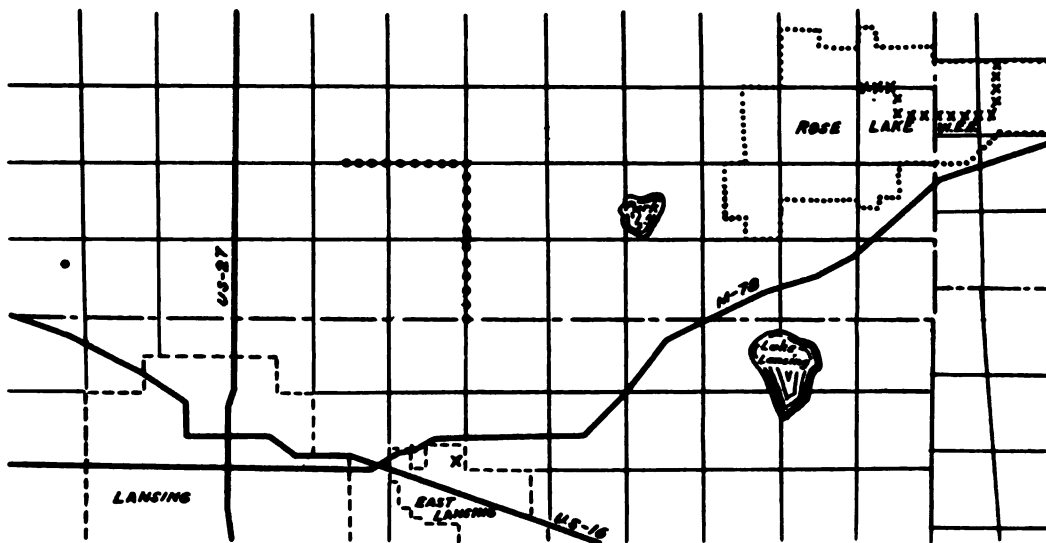
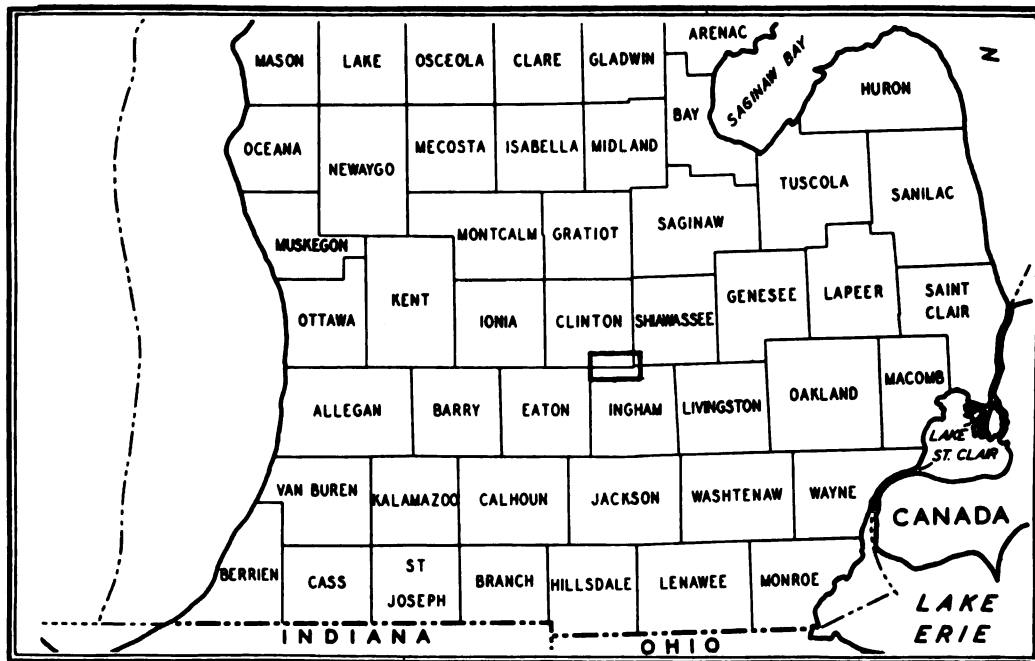


FIGURE 1

# WOODCOCK SINGING-GROUND ROUTES AND SUPPLEMENTARY WEATHER STATIONS

- Lansing Weather Bureau
- Chandler Marsh Route
- x East Lansing Weather Bureau
- xxxx Rose Lake Route

# FLUCTUATIONS IN SINGING-GROUND COUNTS

Variations in the number of woodcock heard during three breeding seasons on two singing-ground routes were considerable (Figures 2, 3, and 4). To test the significance of the observed fluctuations, analyses of variance using paired consecutive readings (Tables 1, 2, and 3) were performed employing the following formula:

	Degrees of Freedom (DF)	Sum of Squares (SS)	Mean Square (MS)	"F"
Total	$\sum n - 1$	$\sum x^2 - \frac{(\sum x)^2}{\sum n}$		
Between	$\frac{1}{2} \sum n - 1$	$\frac{\sum y^2}{2} - \frac{(\sum x)^2}{\sum n}$	$\frac{SS}{DF}$	
Within	Total DF Minus Between DF	Total SS minus Between SS	$\frac{SS}{DF}$	$\frac{\text{Between MS}}{\text{Within MS}}$

"F" values for the three years were calculated as follows:

1954				
	(DF)	(SS)	(MS)	"F"
Total	$(32-1) = 31$	$44.2435 - \frac{(33.25)^2}{32} = 9.6947$		
Between	$(16-1) = 15$	$\frac{86.5653}{2} - \frac{(33.25)^2}{32} = 8.73385$	.582257	9.70 <del>XX</del>
Within	$(31-15) = 16$	$9.6947 - 8.73385 = 0.96085$	.060053	

~~XX~~ Highly Significant

1955

	(DF)	(SS)	(MS)	"F"
Total	(28-1) = 27	33.5346 - $\frac{(27.80)^2}{28} = 5.9332$		
Between	(14-1) = 13	$\frac{64.0302}{2} - \frac{(27.80)^2}{28} = 4.4137$	.3395	
Within	(27-13) = 14	5.9332 - 4.4137 = 1.5195	.1085	3.13 *

\* Significant

1956

	(DF)	(SS)	(MS)	"F"
Total	(30-1) = 29	81.7425 - $\frac{(47.55)^2}{30} = 6.37575$		
Between	(15-1) = 14	$\frac{161.0425}{2} - \frac{(47.55)^2}{30} = 5.15450$	.36818	
Within	(29-14) = 15	6.37575 - 5.15450 = 1.22125	.08142	4.52 **

\*\* Highly significant

Statistically highly significant differences were found between counts on the same route in 1954 and 1956, and differences at the significant level were obtained in 1955. The differences in the observed fluctuations, it was evident, were not likely to be due merely to chance. They were appraised from the standpoints of (1) variation in woodcock activity and (2) variation in the observer's ability to detect woodcock activity.

TABLE 1  
Paired Consecutive Reading Analysis of Variance  
1954 Data

Woodcock heard/stop (x)	Woodcock heard/stop (y)	(x <sup>2</sup> )	(y <sup>2</sup> )
2.17	.	4.7089	
2.50	4.67	6.2500	21.8089
1.00		1.0000	
1.00	2.00	1.0000	4.0000
0.67		0.4489	
0.67	1.34	0.4489	1.7956
1.17		1.3689	
1.33	2.50	1.7689	6.2500
1.67*		2.7889*	
0.50*	2.17	0.2500*	4.7089
1.67*		2.7889*	
1.50*	3.17	2.2500*	10.0489
1.50*		2.2500*	
2.00*	3.50	4.0000*	12.2500
0.67*		0.4489*	
0.67*	1.34	0.4489*	1.7956
0.50*		0.2500*	
0.50*	1.00	0.2500*	1.0000
0.50*		0.2500*	
0.50*	1.00	0.2500*	1.0000
1.40*		1.9600*	
1.33*	2.73	1.7689*	7.4529
1.17*		1.3689*	
1.33*	2.50	1.7689*	6.2500
1.00		1.0000	
1.00	2.00	1.0000	4.0000
0.83		0.6889	
0.83	1.66	0.6889	2.7556
0.50		0.2500	
0.50	1.00	0.2500	1.0000
0.50		0.2500	
<u>0.17</u>	<u>0.67</u>	<u>0.0289</u>	<u>0.4489</u>
$\sum x = 33.25$		$\sum x^2 = 44.2435$	$\sum y^2 = 86.5653$

\* These data were also used for determining confidence limits of the "Central Period", with the following values being obtained:

$$N = 16 \quad \sum x^2 = 23.0923$$

$$\bar{x} = 1.09 \quad (\sum x)^2 = (17.41)^2 = 303.1081$$





TABLE 2

## Paired Consecutive Reading Analysis of Variance

1955 Data

Woodcock Heard/stop (x)	Woodcock Heard/stop (y)	(x <sup>2</sup> )	(y <sup>2</sup> )
1.20		1.4400	
1.60	2.80	2.5600	7.8400
1.60		2.5600	
0.40	2.00	0.1600	4.0000
0.80		0.6400	
1.20	2.00	1.4400	4.0000
1.00		1.0000	
0.33	1.33	0.1089	1.7689
0.50		0.2500	
0.67	1.17	0.4489	1.3689
1.17*		1.3689*	
1.83*	3.00	3.3489*	9.0000
1.17*		1.3689*	
1.67*	2.84	2.7889*	8.0656
1.67*		2.7889*	
1.33*	3.00	1.7689*	9.0000
1.00*		1.0000*	
1.00*	2.00	1.0000*	4.0000
1.17*		1.3689*	
1.17*	2.34	1.3689*	5.4756
1.33*		1.7689*	
1.33*	2.66	1.7689*	7.0756
0.50		0.2500	
0.50	1.00	0.2500	1.0000
0.50		0.2500	
0.50	1.00	0.2500	1.0000
0.33		0.1089	
<u>0.33</u>	<u>0.66</u>	<u>0.1089</u>	<u>0.4356</u>
$\sum x = 27.80$		$\sum x^2 = 33.5346$	$\sum y^2 = 64.0302$

\* These data were also used for determining confidence limits of the "Central Period", with the following values being obtained:

$$N = 12 \quad \sum x^2 = 21.7090$$

$$\bar{X} = 1.32 \quad (\sum x)^2 = (15.84)^2 = 250.9056$$

TABLE 3

## Paired Consecutive Reading Analysis of Variance

1956 Data

Woodcock Heard/stop (x)	Woodcock heard/stop (y)	(x <sup>2</sup> )	(y <sup>2</sup> )
1.75		3.0625	
1.40	3.15	1.9600	9.9225
1.40		1.9600	
1.40	2.80	1.9600	7.8400
1.40		1.9600	
1.00	2.40	1.0000	5.7600
1.40		1.9600	
1.00	2.40	1.0000	5.7600
1.00		1.0000	
1.00	2.00	1.0000	4.0000
1.20		1.4400	
1.00	2.20	1.0000	4.8400
1.80*		3.2400*	
2.20*	4.00	4.8400*	16.0000
1.60*		2.5600*	
2.00*	3.60	4.0000*	12.9600
2.20*		4.8400*	
2.20*	4.40	4.8400*	19.3600
2.00*		4.0000*	
1.20*	3.20	1.4400*	10.2400
2.20*		4.8400*	
2.20*	4.40	4.8400*	19.3600
2.00*		4.0000*	
2.00*	4.00	4.0000*	16.0000
2.00*		4.0000*	
2.00*	4.00	4.0000*	16.0000
1.20*		1.4400*	
1.80*	3.00	3.2400*	9.0000
1.40		1.9600	
<u>0.60</u>	<u>2.00</u>	<u>0.3600</u>	<u>4.0000</u>

$$\sum x = 47.55$$

$$\sum x^2 = 81.7425 \quad \sum y^2 = 161.0425$$

\* These data were also used for determining confidence limits of the "Central Period", with the following values being obtained:

$$N = 16$$

$$\sum x^2 = 60.1200$$

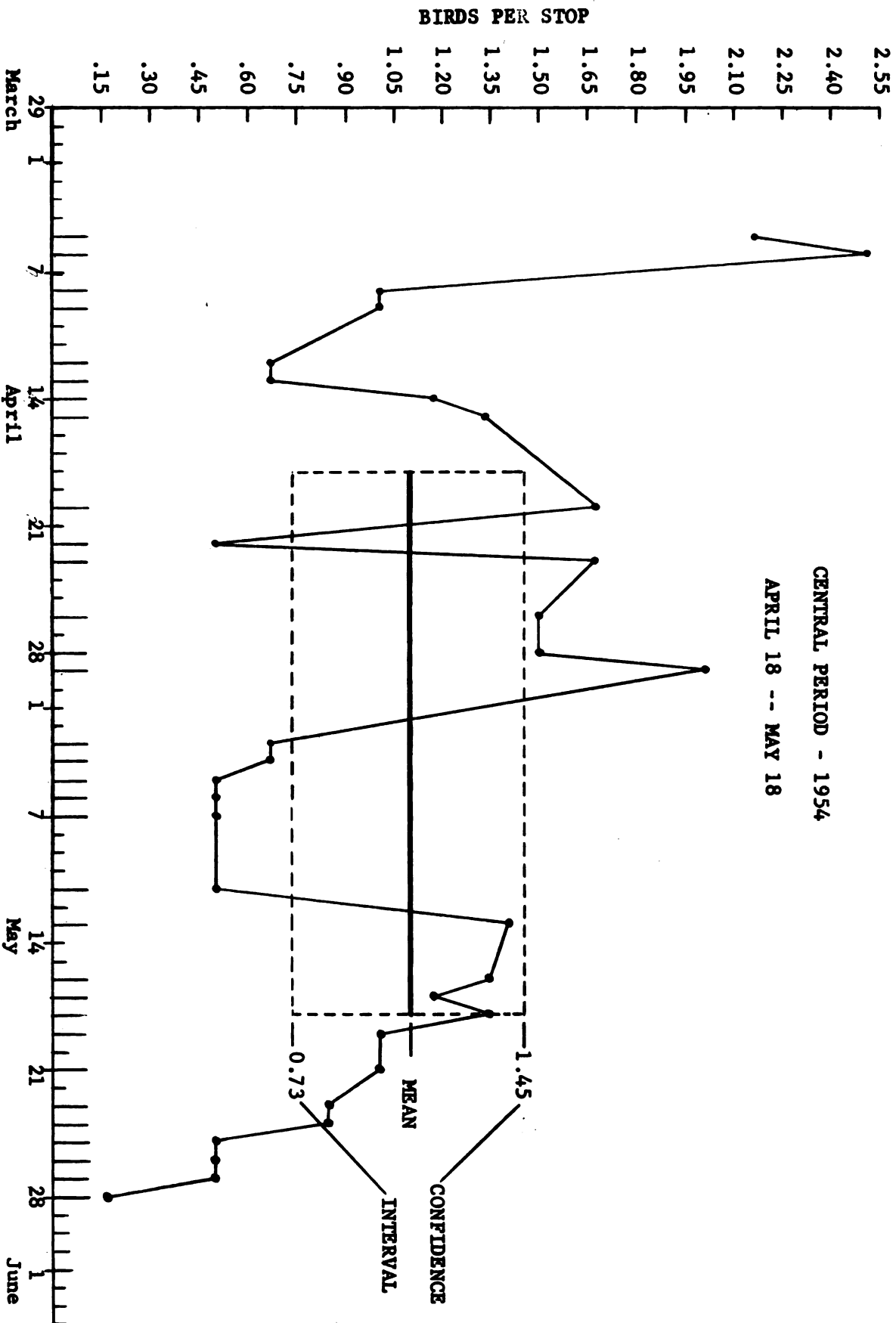
$$\bar{x} = 1.91$$

$$(\sum x)^2 = (30.60)^2 = 936.3600$$

**FIGURE 2**

**1954 FLUCTUATIONS IN THE NUMBER OF WOODCOCK HEARD PER STOP, WITH  
THE "CENTRAL PERIOD" AND CONFIDENCE INTERVAL FOR THE MEAN OF THE  
"CENTRAL PERIOD" INDICATED**

- Woodcock Heard Per Stop
- \_\_\_\_\_ Fluctuations In The Number Of Woodcock Heard Per Stop
- | Limits Of The "Central Period"
- |
- \_\_\_\_\_ Mean Of The "Central Period"
- — — Limits Of The Mean (Confidence Limits)



**FIGURE 3**

**1955 FLUCTUATIONS IN THE NUMBER OF WOODCOCK HEARD PER STOP, WITH  
THE "CENTRAL PERIOD" AND CONFIDENCE INTERVAL FOR THE MEAN OF THE  
"CENTRAL PERIOD" INDICATED**

- Woodcock Heard Per Stop
- \_\_\_\_\_ Fluctuations In The Number Of Woodcock Heard Per Stop
- | Limits Of The "Central Period"
- \_\_\_\_\_ Mean Of The "Central Period"
- — Limits Of The Mean (Confidence Limits)

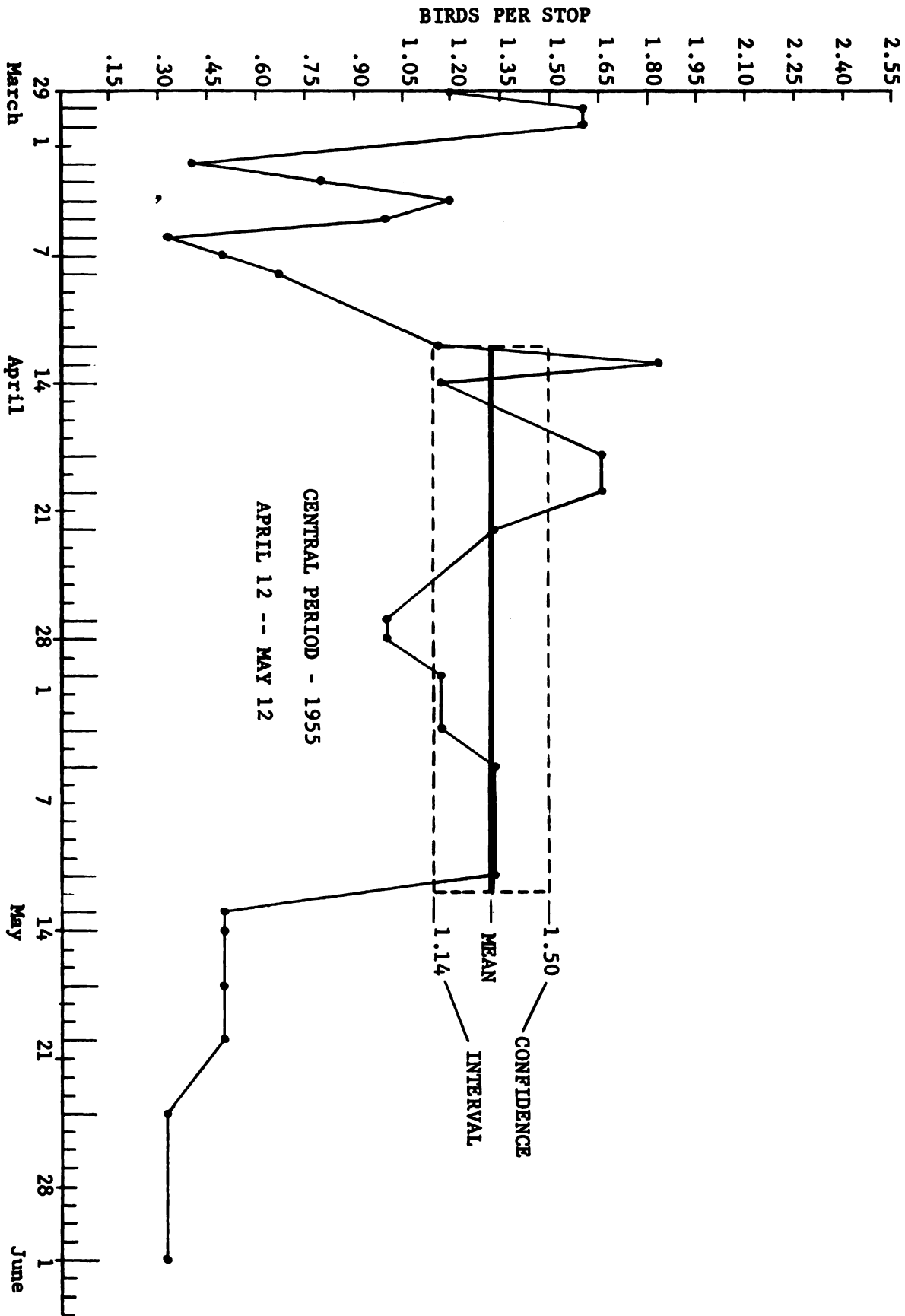


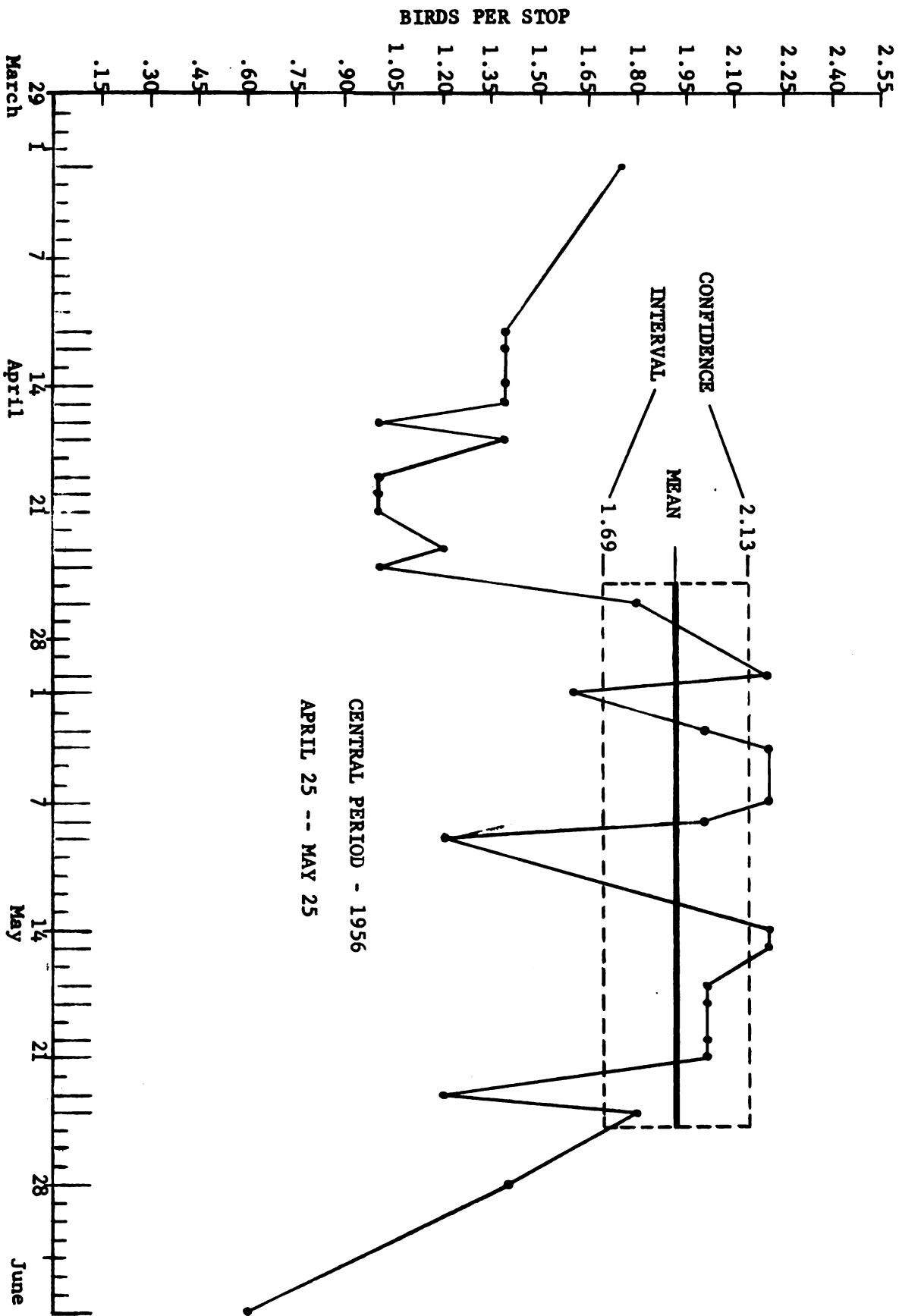


FIGURE 4

1956 FLUCTUATIONS IN THE NUMBER OF WOODCOCK HEARD PER STOP, WITH  
THE "CENTRAL PERIOD" AND CONFIDENCE INTERVAL FOR THE MEAN OF THE  
"CENTRAL PERIOD" INDICATED

• Woodcock Heard Per Stop  
\_\_\_\_\_ Fluctuations In The Number of Woodcock Heard Per Stop  
| Limits Of The "Central Period"  
|  
\_\_\_\_\_ Mean Of The "Central Period"  
— — — Limits Of The Mean (Confidence Limits)







## FACTORS AFFECTING WOODCOCK ACTIVITY ON THEIR SINGING GROUNDS

TIME OF YEAR - Male woodcock courtship performances begin each spring as soon as they have returned to the breeding grounds, and they continue through the nesting period (Edminster, 1954). Blankenship (1957) found the major nesting effort and main portion of the breeding activity occurring in the last two weeks of April and first two weeks of May in the Lower Peninsula of Michigan. However, Edminster (1954) stated that the time of nesting depends on whether the spring season is early or late.

On the study areas of this investigation, the courtship period each year extended from the last week in March through the first week in June. Gradually-increasing numbers of migrants and cessation of breeding, respectively, seemed likely to be largely responsible for the variation in numbers of woodcock heard at the beginning and end of each breeding season. In order that counts would not be influenced unduly by variation due to this progression of the breeding season, a "central period" was established. It was determined separately for each of the three years so as to include the 30-day period of courtship activity with the most consistent series of counts. The beginning of this relatively consistent period varied each spring (Figures 2, 3, and 4), thus agreeing with Edminster's statement relating the time of nesting to seasonal factors, and supporting Mendall and Aldous' (1943) view that the hatching season is directly correlated with weather conditions. Unless otherwise noted, analysis of the remaining factors affecting woodcock indexes involves only those counts conducted within the "central period".

For each of the three years, confidence limits were determined for the mean number of woodcock heard per stop for counts conducted during the "central period" (Tables 1, 2, and 3). Confidence limits were accepted as  $\bar{x} \pm .68s$ ; where  $\bar{x}$  is the mean of the "central period" and  $s$  is the standard deviation of the counts. This method, derived from Snedecor (1946), established limits within which half of the observations (counts) would fall:

$$\text{Variance (mean square): } s^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{N}}{N-1}$$

$$\text{Standard deviation: } s = \sqrt{s^2}$$

$$\text{Confidence limits: } \bar{x} \pm .68s$$

Confidence limits for the three years were calculated as follows:

1954

$$\text{Variance } (s^2) = \frac{23.0923 - \frac{303.1081}{16}}{16-1} = .2765$$

$$\text{Standard deviation } (s) = \sqrt{0.2765} = .5258$$

$$\begin{aligned} \text{Confidence limits} &= 1.09 + (.68 \times .5258 = .36) = 1.45 \\ &= 1.09 - (.68 \times .5258 = .36) = 0.73 \end{aligned}$$

1955

$$\text{Variance } (s^2) = \frac{21.7090 - \frac{250.9056}{12}}{12-1} = .07275$$

$$\text{Standard deviation } (s) = \sqrt{.07275} = .2697$$

$$\begin{aligned}\text{Confidence limits} &= 1.32 + (.68 \times .2697 = .18) = 1.50 \\ &= 1.32 - (.68 \times .2697 = .18) = 1.14\end{aligned}$$

1956

$$\text{Variance } (s^2) = \frac{60.1200 - \frac{936.3600}{16}}{16-1} = .10667$$

$$\text{Standard deviation } (s) = \sqrt{.10667} = .3266$$

$$\begin{aligned}\text{Confidence limits} &= 1.91 + (.68 \times .3266 = .22) = 2.13 \\ &= 1.91 - (.68 \times .3266 = .22) = 1.69\end{aligned}$$

TIME OF DAY - Woodcock are affected by variation in light during their crepuscular courtship periods (Mendall and Aldous, 1943). Cloud cover and phase of the moon are two factors causing daily variation in light conditions at dawn and dusk. The percentage cloud cover and moon phase were estimated and recorded in the field at the time of the first singing-ground flight. Any changes in the amount of cloud cover present during the count were also noted. Official phases of the moon were obtained from "The Systementry Year Book" (Anonymous, 1954, 1955, 1956).

The time interval between official sunset and first flight from the singing ground varied from 8 to 34 minutes on the basis of 34 observations. The mean and median of these time intervals were computed and an average interval obtained. Average time intervals in relation

to percentage cloud cover at the time of first flight were: 27 minutes at 0-30% cloud cover, 23½ minutes at 35-65%, and 19 minutes at 70-100% (Figure 5).

Mendall (1955) has stated that woodcock were very inconsistent in performing during the period two days before a full moon and one day afterwards. Counts conducted during the full moon period of this study, however, were not inconsistent. Six counts were conducted during the full moon period with an average cloud cover of less than 35%. Only one of these counts fell outside the confidence limits of the mean, and it is probable that low temperature was more important than moonlight in causing the decrease in woodcock heard that evening. Various investigations, including this one, have revealed that woodcock begin their courtship activities later and continue longer with a bright moon overhead. During the 30 minutes immediately following the first singing-ground flight, however, no inconsistency due to a full moon was observed.

TEMPERATURE - This factor was found to be the most important of the several climatological elements affecting woodcock courtship activity.

In 1954, temperatures were not recorded in the field but were obtained from the U. S. Weather Bureau at the Capital City Airport, Lansing, approximately five miles west of the study area. In 1955 and 1956, temperatures were recorded at the beginning of each count with a Taylor binoc-type thermometer held four feet above the ground at roadside. Of 55 comparable comparisons with airport weather records in 1955 and 1956, 52 were higher (averaging 3.5°F. increase) than the field-recorded temperatures. To render the temperatures for the three

**FIGURE 5**

**TIME INTERVAL BETWEEN FIRST SINGING-GROUND FLIGHT AND OFFICIAL  
SUNSET IN RELATION TO PER CENT OF CLOUD COVER PRESENT AT THE  
TIME OF THE FIRST FLIGHT**

**. Individual (Daily) Comparisons**

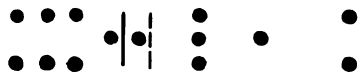
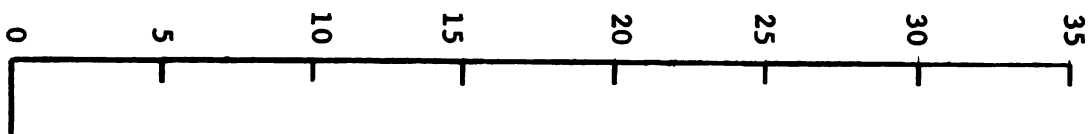
**\_\_\_\_\_ Median Time Interval (Minutes) For Each Percentage**

**Cloud Cover Group**

**-- -- -- Mean Time Interval (Minutes) For Each Percentage**

**Cloud Cover Group**

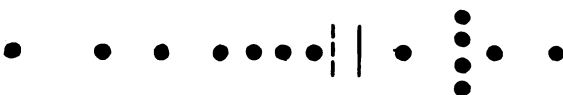
# MINUTES BETWEEN OFFICIAL SUNSET AND FIRST SINGING GROUND FLIGHT



0-30



35-65



70-100

PERCENTAGE CLOUD COVER AT TIME OF FIRST SINGING GROUND FLIGHT



years comparable, therefore, those of 1954 were reduced three degrees each.

The U. S. Fish and Wildlife Service (1960) instructed that counts not be made when the temperature was below 25°F. During this study, however, whenever air temperatures along the roadside were below 41°F. at the time of the first singing-ground flight, the number of woodcock heard was less than the lower confidence limit of the mean (Figure 6). This occurred five times within the "central period". Low temperatures, moreover, may well have been the primary climatological factor limiting courtship activity prior to the "central period" (Figures 2, 3, and 4).

During the 1955 study, additional air temperatures were recorded at the conclusion of eight counts on one actively occupied singing ground and at the nearby roadside. Temperatures on the singing ground in this experiment were measured three inches above the sod. Here, temperatures averaged nine degrees lower than corresponding roadside temperatures and eleven degrees below the roadside temperatures recorded 30 to 35 minutes earlier at the beginning of the counts. Since air temperatures at the roadside may be considerably higher than air temperatures on singing grounds and since they normally decrease as the evening progresses, the minimum roadside temperatures for conducting counts should be set high enough to insure normal courtship activity along the entire route. Temperatures above 40° F. at roadside seem to be required.

PRECIPITATION - Rain and snow were encountered so infrequently while conducting counts that no new information was obtained. Blankenship (1957)

determined that rain and snow reduced singing-ground activity more or less directly. Edminster (1954) stated that woodcock are very active in light mist on warm nights, though Mendall and Aldous (1943) found that heavy fog or mist curtailed much of the singing-ground activity during cold temperatures. Aldrich (1954) recommended that counts for the Fish and Wildlife Service not be made in heavy rain or snow.

WIND VELOCITY - Pettingill (1936) concluded that winds apparently have little effect on breeding activities. Edminster (1954) and Mendall and Aldous (1943), however, stated that strong winds reduce or entirely curtail courtship activity. Robbins (1954) found that winds above five miles per hour invariably reduce winnowing activities of the related Wilson's snipe. Blankenship (1957) stated that woodcock activity becomes erratic when wind velocities reach 13-18 miles per hour. Observations during this study indicated that woodcock peented actively but flew less when wind velocities were above 15 miles per hour. Wind also affected the observer's hearing ability (see beyond).

## FACTORS AFFECTING OBSERVATIONS OF SINGING-GROUND ACTIVITY

WIND VELOCITY - Blankenship (1954) found that on windy evenings the hearing distance of "peents" was greatly reduced. The U. S. Fish and Wildlife Service (1960) stated that a wind velocity of 8-10 miles per hour was too strong for conducting singing-ground counts. The present investigation, however, does not entirely support this contention.

During this study, wind velocity was estimated at every stop by the Beaufort Wind Scale observation method (Americana Encyclopedia, 1956). On the five evenings when the average wind velocity was 15 or more miles per hour, the number of woodcock heard was less than the lower confidence limit of the mean (Figure 6).

Thirteen counts were conducted with an average wind velocity above eight and less than 15 miles per hour. Results from six of these counts were above the upper confidence limit of the mean and six other counts were within the accepted confidence limits. The only count to fall below the lower confidence limit of the mean occurred when it was also true that the roadside air temperature was 36° F. at the time of the first singing-ground flight (Figures 2, 3, 4, and 6).

INTERFERENCE - Disturbances other than wind velocities often seemed to decrease the observer's ability to hear courtship activity. Such interference originated from highway traffic, trains, airplanes, farming operations, frogs, dogs, birds, mosquitoes, etc. The following scale was developed and the amount of interference was recorded at each stop along the route.

### Interference Scale

Description	Rank
Noises of short duration or of light intensity. Listening period disrupted up to 30 seconds.	1
Appreciable disruption, such as a car passing during count. Listening period shortened between 31 and 60 seconds.	2
Disruption of such intensity or duration that woodcock courtship activity might not be heard. Difficulty encountered by observer in concentrating on the objective. Listening period shortened by 61 to 90 seconds.	3
Interference such that it is impossible to hear woodcock performing. (Train, tractor, etc. located very near stop.) Listening period disrupted from 91 seconds to the end of the 2-minute period. Data from such locations should be eliminated from analysis.	4

Whenever the average interference for a route totalled above 2.25 on this scale, the number of woodcock heard on that route was below the lower confidence limit of the mean (Figure 6).

HEARING VARIATION - Since individual hearing ability varies considerably (Dorney et al., 1958) and since hearing differences have been noted among observers on pheasant crowing cock counts (Carney and Petrides, 1957), experiments were conducted to determine whether variation in hearing courting males occurred among woodcock observers. These tests were not designed for statistical analysis, but three individuals tested were unable to hear woodcock ground activity (peenting) over 65 yards away. One of these apparently could not pick up the frequency pitch at any distance. Variation among 18 other individuals, including six experienced observers, however, was negligible.


FIGURE 6

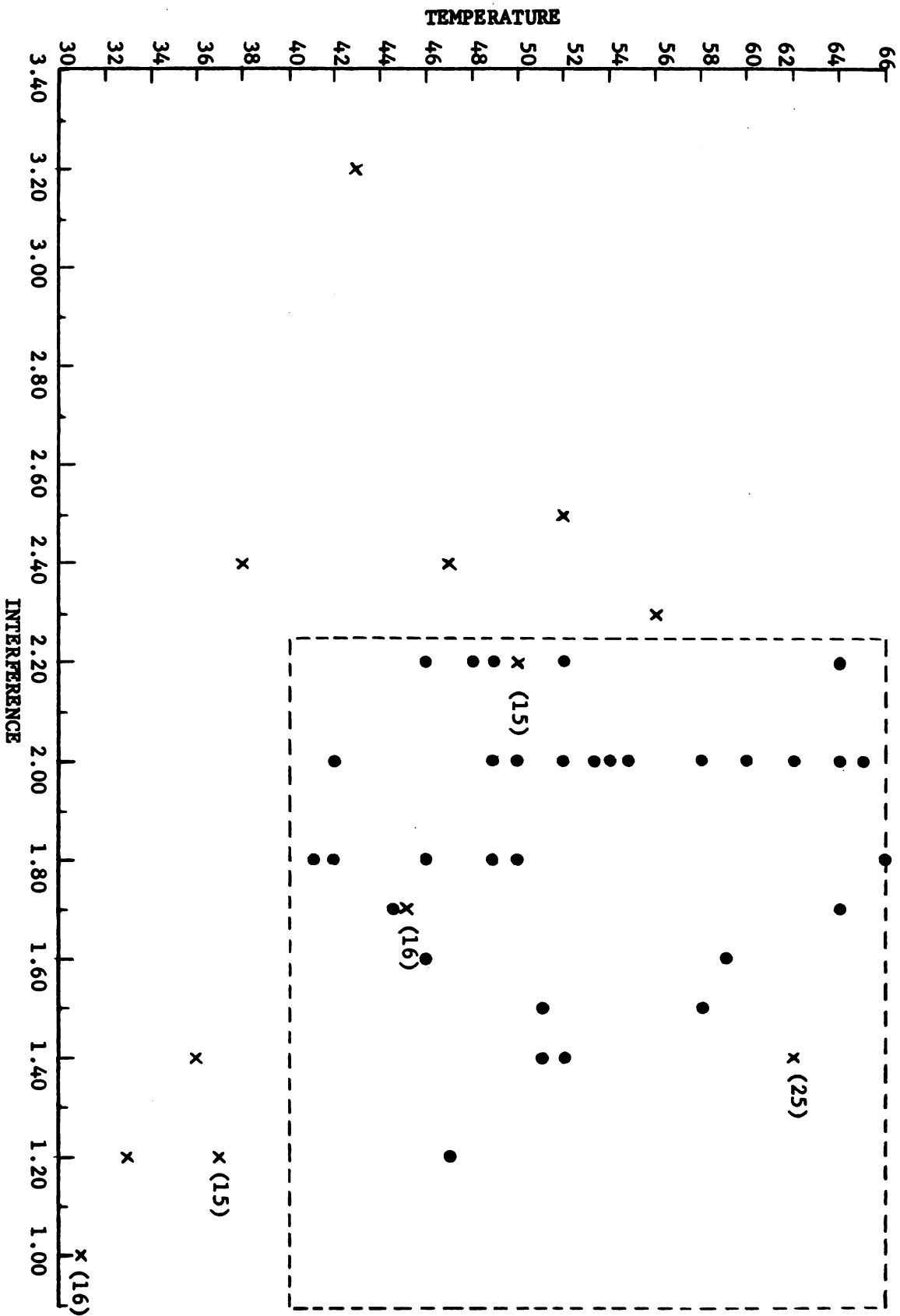
SCATTERGRAM COMPARISONS BETWEEN INTERFERENCE, TEMPERATURE, WIND  
VELOCITY AND COUNTS

X Counts Below the Lower Confidence Limit Of The Mean.

• Counts Above Or Within The Mean's Range.

(MPH) Wind Velocities Considered Critical (15 or more Mi./Hr.).

	Within Box: Counts Conducted With Average Temperatures Above 40°F. And The Interference Average Less Than 2.25. All Were Above Or Within The Confidence Limits Of The Mean, Except For Counts During Which The Average Wind Velocity Was 15 Or More Miles Per Hour.
	Outside Box: Counts Conducted With Average Temperatures Below 40°F. And The Interference Average More Than 2.25. All Of These Counts Were Below The Lower Confidence Limit Of The Mean.



MISCELLANEOUS FACTORS - Woodcock are promiscuous and males occasionally change singing grounds (Sheldon, 1953). However, Sheldon and Blankenship (1957) both found that these vacated locations were usually promptly occupied by another male.

Blankenship (1957) cited several instances of courting males being disturbed by farming activities or by other animals nearby. He indicated that this may cause erratic courtship activity or a temporary change in singing-ground location.

## RECOMMENDATIONS

On the basis of this study, the following recommendations are suggested for standardization of woodcock singing-ground counts in southern Michigan:

1. Counts should be made during the period April 20 - May 10.
2. Counts should be limited to the 30 minutes immediately following the first singing-ground flight.
3. Roadside air temperatures should be above 40° F. at the time of the first singing-ground flight.
4. Wind velocities should be less than 15 miles per hour.
5. When the interference index is 4 for a single stop or above 2.25 average per stop for the total route, the data for that stop or route should be eliminated from analysis.



## SUMMARY

American Woodcock (Philohela minor) spring population-level estimates commonly are determined from roadside counts of males on their singing grounds. This study was undertaken to attempt improvement in the accuracy of these index counts.

In 1954, 1955, and 1956, an average of thirty counts were conducted each spring on one or the other of two southern Michigan singing-ground routes. Statistically significant differences were found among many of these counts. The causes of this variation were ascertained by determining (1) the effect of various biological and climatological conditions on woodcock courtship activity, and (2) the factors affecting observers' abilities to hear the singing-ground performance.

Singing-ground counts in southern Michigan were found to be most consistent during the annual period April 20 - May 10, coinciding with the peak of courtship and nesting seasons. Commencement of evening singing-ground performances was determined by the time of sunset as related to the percentage of cloud cover. By limiting counts to the 30 minutes immediately following the first singing-ground flight, inconsistencies from the effects of moonlight were avoided. Reduced courtship activity was invariably observed when air temperatures at the roadside were 40° F. or below at the beginning of the count. Variation among observers in hearing singing-ground activity was slight. The ability of observers to hear woodcock, however, was appreciably reduced when wind velocities were 15 miles per hour or more and when other sources of noise were too long or intense.

Recommendations based on the above findings were suggested for standardization of woodcock singing-ground counts in southern Michigan.

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## **A P P E N D I X**

WOODCOCK SINGING GROUND DATA - - 1954

DATE	TEMPERATURE	WIND VELOCITY	INTERFERENCE	BIRDS HEARD	BIRDS HEARD
of Count	Beginning of Count*	Average During Count	Average During Count	Total	Per Stop
April 5	49	--	--	13	2.17
" 6	56	9	--	15	2.50
" 8	32	2	--	5	1.00
" 9	43	--	--	6	1.00
" 12	42	13	--	4	0.67
" 13	57	2	1.5	4	0.67
" 14	64	2	--	7	1.17
" 15	66	13	--	8	1.33
" 20	48	10	2.2	10	1.67
" 22	47	2	2.4	3	0.50
" 23	45	4	1.7	10	1.67
" 26	59	9	1.6	9	1.50
" 28	47	2	1.2	9	1.50
" 29	51	2	1.4	12	2.00
May 3	31	16	1.0	4	0.67
" 4	37	15	1.2	4	0.67
" 5	33	7	1.2	3	0.50
" 6	43	3	3.2	3	0.50
" 7	38	4	2.4	3	0.50
" 11	45	16	1.7	3	0.50
" 13	52	2	1.4	7	1.40
" 16	58	2	2.0	8	1.33
" 17	49	4	2.2	7	1.17
" 18	50	3	2.0	8	1.33
" 19	43	8	2.0	6	1.00
" 21	53	6	1.7	6	1.00
" 23	61	2	1.7	5	0.83
" 24	63	11	1.8	5	0.83
" 25	52	2	2.5	3	0.50
" 26	56	10	1.8	3	0.50
" 27	57	17	1.3	3	0.50
" 28	68	19	1.0	1	0.17

\*Information obtained from the United States Department of Commerce, Weather Bureau, Lansing, Michigan (Capitol City Airport - Latitude 42° 47' N.; Longitude 84° 36' W.; Ground Elevation 859 feet). The temperatures at the beginning of the counts have been corrected (reduced 3 degrees) to field temperatures.

# WOODCOCK SINGING GROUND DATA - - 1954

DATE		PRECIPITATION		CLOUD COVER (%)	MOON**	BIRDS HEARD	BIRDS HEARD
of Count		Daily Total*	During Count	Beginning of Count	Full Period	Total	Per Stop
April	5	0	0	-		13	2.17
"	6	0.21	0	100		15	2.50
"	8	T	0	0		5	1.00
"	9	0	0	100		6	1.00
"	12	0	0	0		4	0.67
"	13	0	0	70		4	0.67
"	14	0	0	50		7	1.17
"	15	0.67	0	90	plus 2 full (17th)	8	1.33
"	20	0.43	0	100		10	1.67
"	22	0.05	0	-		3	0.50
"	23	0	0	0		10	1.67
"	26	0.66	0	50		9	1.50
"	28	T	0	100		9	1.50
"	29	T	0	25		12	2.00
May	3	0.02	T	50		4	0.67
"	4	0.03	0	100		4	0.67
"	5	T	0	90		3	0.50
"	6	T	0	60		3	0.50
"	7	0	0	0		3	0.50
"	11	0.01	0	100		3	0.50
"	13	0	0	20		7	1.40
"	16	0	0	20	plus 1 full	8	1.33
"	17	0	0	20	minus 1	7	1.17
"	18	T	0	90		8	1.33
"	19	0	0	0		6	1.00
"	21	0	0	10		6	1.00
"	23	0	0	30		5	0.83
"	24	0	0	90		5	0.83
"	25	0	0	30		3	0.50
"	26	0	0	100		3	0.50
"	27	0.04	T	100		3	0.50
"	28	T	0	80		1	0.17

\*Information obtained from the United States Department of Commerce, Weather Bureau, East Lansing, Michigan. (Latitude 42° 44' N.; Longitude 84° 29' W.; Ground Elevation 856 feet).

\*\*Dates of the full moon obtained from The Systemetry Year Book, 1954, published by Shedd-Brown, Minneapolis, Minnesota.



## MISCELLANEOUS CLIMATOLOGICAL DATA -- 1954\*

### APRIL:

Temperature (°F):

Precipitation (In.):

Monthly Average = 48.5

Monthly Total = 2.75

Departure From Normal = +3.2

Departure From Normal = -0.08

This April was the warmest April since 1948, with an average temperature 3.2° above normal. Total snowfall for the month of 0.1 inches was 2.6 inches below normal.

### MAY:

Temperature (°F):

Precipitation (In.):

Monthly Average = 53.0

Monthly Total = 1.14

Departure From Normal = -3.5

Departure From Normal = -2.61

This May was 3.50 below normal in temperature, making it the coldest May since 1947. Precipitation was 2.61 inches below normal. Up to the 31st, only 0.34 inches had occurred. Had we not had 0.80 inches on the 31st, this May would have been the third driest May since the beginning of record and the sixth driest of any month since 1900.

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\*Information obtained from the United States Department of Commerce, Weather Bureau, Lansing, Michigan (Capitol City Airport - Latitude 42° 47' N.; Longitude 84° 36' W.; Ground Elevation 859 feet).

WOODCOCK SINGING GROUND DATA - - 1955

DATE	TEMPERATURE	WIND VELOCITY	INTERFERENCE	BIRDS HEARD	BIRDS HEARD
of Count	Beginning of Count	Average During Count	Average During Count	Total	Per Stop
March 29	--	2	--	6	1.20
" 30	45	2	1.4	8	1.60
" 31	51	2	1.6	8	1.60
April 2	55	15	1.6	2	0.40
" 3	42	10	2.2	4	0.80
" 4	43	11	2.2	6	1.20
" 5	54	9	2.7	6	1.00
" 6	40	19	1.7	2	0.33
" 7	36	9	1.7	3	0.50
" 8	50	7	2.3	4	0.67
" 12	64	13	2.2	7	1.17
" 13	65	4	2.0	11	1.83
" 14	62	13	2.0	7	1.17
" 18	58	13	1.5	10	1.67
" 20	64	13	1.7	10	1.67
" 22	52	4	2.2	8	1.33
" 27	52	2	2.5	6	1.00
" 28	56	2	2.3	6	1.00
" 30	54	2	2.0	7	1.17
May 3	68	2	1.8	7	1.17
" 5	54	11	2.0	8	1.33
" 11	51	2	1.5	8	1.33
" 13	59	15	1.7	3	0.50
" 14	55	9	2.0	3	0.50
" 17	50	2	1.2	3	0.50
" 20	57	2	1.3	3	0.50
" 24	65	6	1.5	2	0.33
June 1	55	2	1.8	2	0.33

# WOODCOCK SINGING GROUND DATA - - 1955

DATE	PRECIPITATION		CLOUD COVER (%)	MOON**	BIRDS HEARD	BIRDS HEARD
of Count	Daily Total*	During Count	Beginning of Count	Full Period	Total	Per Stop
March 29	0	0	0		6	1.20
" 30	0	0	0		8	1.60
" 31	0	0	0		8	1.60
April 2	0	0	40		2	0.40
" 3	0	0	10		4	0.80
" 4	0	0	90		6	1.20
" 5	0.03	0	5	plus 2	6	1.00
" 6	T	0	100	plus 1	2	0.33
" 7	T	0	10	full	3	0.50
" 8	0	0	5	minus 1	4	0.67
" 12	0.09	0	30		7	1.17
" 13	0.03	0	40		11	1.83
" 14	0	0	80		7	1.17
" 18	0.14	0	85		10	1.67
" 20	0.04	0	60		10	1.67
" 22	0	0	5		8	1.33
" 27	0	0	0		6	1.00
" 28	0	0	5		6	1.00
" 30	0	0	5		7	1.17
May 3	0	0	10		7	1.17
" 5	0	0	0	plus 1 full 6th	8	1.33
" 11	0	0	30		8	1.33
" 13	0	0	80		3	0.50
" 14	0	0	0		3	0.50
" 17	0	0	0		3	0.50
" 20	0	0	0		3	0.50
" 24	0.34	T	100		2	0.33
June 1	0	0	5		2	0.33

\*Information obtained from the United States Department of Commerce, Weather Bureau, East Lansing, Michigan. (Latitude 42° 44' N.; Longitude 84° 29' W.; Ground Elevation 856 feet).

\*\*Dates of the full moon obtained from The Systementry Year Book, 1955, published by Shedd-Brown, Minneapolis, Minnesota.

# MISCELLANEOUS CLIMATOLOGICAL DATA -- 1955\*

## APRIL:

Temperature (°F):

Precipitation (In.):

Monthly Average = 54.5

Monthly Total = 1.56

Departure From Normal = +9.2

Departure From Normal = -1.27

April, 1955 was the warmest April since 1864. Temperatures were above normal every day except three. Previously, the warmest April occurred in 1896 when the monthly average was 52.6 degrees.

## MAY:

Temperature (°F):

Precipitation (In.):

Monthly Average = 61.0

Monthly Total = 1.53

Departure From Normal = + 4.5

Departure From Normal = -2.22

Considerably above normal temperatures and below normal precipitation continued for the second month in a row. Total accumulated deficit in rainfall for April and May amounted to 3.49 inches while it was the warmest May since 1922.

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\* Information obtained from the United States Department of Commerce, Weather Bureau, East Lansing, Michigan (Latitude 42° 44' N.; Longitude 84° 29' W.; Ground Elevation 856 feet).

WOODCOCK SINGING GROUND DATA - - 1956

DATE	TEMPERATURE	WIND VELOCITY	INTERFERENCE	BIRDS HEARD	BIRDS HEARD
of Count	Beginning of Count	Average During Count	Average During Count	Total	Per Stop
April 2	55	2	2.0	7	1.75
" 11	46	6	2.2	7	1.40
" 12	40	12	2.0	7	1.40
" 14	56	14	1.4	7	1.40
" 15	40	7	1.6	7	1.40
" 16	37	23	1.4	5	1.00
" 17	34	20	1.6	7	1.40
" 19	36	17	1.8	5	1.00
" 20	38	11	1.6	5	1.00
" 21	44	8	1.6	5	1.00
" 23	33	2	2.6	6	1.20
" 24	35	2	2.4	5	1.00
" 26	46	2	2.2	9	1.80
" 30	41	2	1.8	11	2.20
May 1	50	15	2.2	8	1.60
" 3	50	4	1.8	10	2.00
" 4	49	5	1.8	11	2.20
" 7	46	12	1.8	11	2.20
" 8	46	10	1.6	10	2.00
" 9	62	25	1.4	6	1.20
" 14	54	2	2.0	11	2.20
" 15	52	6	2.0	11	2.20
" 17	42	12	1.8	10	2.00
" 18	60	13	2.0	10	2.00
" 20	49	10	2.0	10	2.00
" 21	64	2	2.0	10	2.00
" 23	36	11	1.4	6	1.20
" 24	42	2	2.0	9	1.80
" 28	60	2	1.7	7	1.40
June 4	52	3	1.8	3	0.60

WOODCOCK SINGING GROUND DATA - - 1956

DATE		PRECIPITATION		CLOUD COVER (%)	MOON**	BIRDS HEARD	BIRDS HEARD
of Count		Daily Total*	During Count	Beginning of Count	Full Period	Total	Per Stop
April	2	0.15	0	100		7	1.75
"	11	0	0	10		7	1.40
"	12	T	0	10		7	1.40
"	14	0.07	0	25		7	1.40
"	15	0	0	100		7	1.40
"	16	0.04	0	100		5	1.00
"	17	0.09	T	100		7	1.40
"	19	0	0	5		5	1.00
"	20	0	0	10		5	1.00
"	21	T	0	15		5	1.00
"	23	0	0	20	minus 1	6	1.20
"	24	0	0	10	full	5	1.00
"	26	0	0	85		9	1.80
"	30	T	0	5		11	2.20
May	1	0	0	50		8	1.60
"	3	0.05	T	100		10	2.00
"	4	0.58	0	10		11	2.20
"	7	0	0	5		11	2.20
"	8	0	0	0		10	2.00
"	9	1.76	0.02	100		6	1.20
"	14	0	0	60		11	2.20
"	15	0.43	0	100		11	2.20
"	17	0.15	0	100		10	2.00
"	18	0.01	0	25		10	2.00
"	20	0.01	0	95		10	2.00
"	21	T	0	20		10	2.00
"	23	0	0	0	minus 1	6	1.20
"	24	0	0	70	full	9	1.80
"	28	0	0	5		7	1.40
June	4	T	0	20		3	0.60

\*Information obtained from the United States Department of Commerce, Weather Bureau, East Lansing, Michigan. (Latitude 42° 44' N.; Longitude 84° 29' W.; Ground Elevation 856 feet).

\*\*Dates of the full moon obtained from The Systementry Year Book, 1956, published by Shedd-Brown, Minneapolis, Minnesota.

# MISCELLANEOUS CLIMATOLOGICAL DATA -- 1956\*

## APRIL:

Temperature (°F):

Precipitation (In.):

Monthly average = 44.6

Monthly Total = 4.27

Departure From Normal = -0.7

Departure From Normal = +1.44

April, 1956 was 10 degrees colder than April of last year. The first six days averaged 13 degrees above normal while the last 24 days averaged 4 degrees below normal. Rain on the 27th through 29th, totaling 3.25 inches, was the heaviest since May 10-12, 1948, when 3.28 inches fell.

## MAY:

Temperature (°F):

Precipitation (In.):

Monthly Average = 56.4

Monthly Total = 5.60

Departure From Normal = -0.1

Departure From Normal = +1.85

May, 1956 had above normal rainfall for the second month in a row.

Tornado alerts were issued on the 11th, 12th and 13th.

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\*Information obtained from the United States Department of Commerce, Weather Bureau, East Lansing, Michigan (Latitude 42° 44' N.; Longitude 84° 29' W.; Ground Elevation 856 feet).

# Instructions for the Censusing of Woodcock, 1960

## I. Introduction

(Some changes in Section I since 1959)

Woodcock can be censused most easily by counting the number of males heard calling along a given length of road running through territory which woodcock inhabit during the breeding season.

The purpose of this type of census is to obtain an index of population abundance in the region sampled, not to determine the total population in any area. The principle involved is to make the observations as standardized as possible both as to time and space, so that they will be comparable with results obtained in different regions and in different years. To accomplish this, trips are made over a given route. Stops are always made at the same place and of definite duration. The number of birds heard calling per stop per route is taken as the index of abundance for that particular area. With these objectives in view and considering all that has been learned to date of woodcock behavior and the problems of recording their calls, the following standard method has been decided upon. If for any reason you will be unable to cover last year's route, please notify your coordinator before April 1.

## II. Locating the Census Area

Careful consideration should be given to locating the census area. Since the count can be made most effectively by using an automobile, a driveable route will necessarily need to be selected. A stretch of road bordered by numerous alder runs, open young mixed growths, or young hardwood stands (especially where numerous small openings, fields or pastures occur) probably will yield counts representative of the best type of woodcock cover. A few scattered houses along the road will not detract from the suitability of the census route. However, care should be taken to avoid areas where excessive noises will occur, such as small settlements, heavily traveled highways, and series of small ponds or drainage ditches which are likely to contribute noisy choruses of frogs.

## III. Length of the Census Route

The length of your route should be based on the distance that can be covered during the minimum time woodcock have been observed calling in your area. If there is any doubt on this point use the arbitrary time of thirty minutes. The length of the route will vary with woodcock population densities. With discontinuous habitat and a low population it may be possible to cover more than 4 miles, whereas in areas of high concentration 3 miles may be all that can be covered. If a route longer than can be covered during the singing period in one evening is available it may be divided into two or more individual routes and covered in separate evenings.

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#### IV. Taking the Census

(Some changes in Paragraph 2 of Section IV since 1959)

1. Note to beginners.--To those who are wholly unfamiliar with the courtship behavior of the woodcock and the census technique, it is suggested that they spend some time (in the field particularly) with one experienced person before starting out on their own.

2. Time of year to start the census.--The time of the year the census should be started will vary with the locality and region. Woodcock being migratory will visit states south of New England, and equivalent areas to the west, much earlier than Maine or northern Minnesota, for example. The census work should be carried out after migration has ceased in a given locality and before the peak of the hatching period. For example, in Pennsylvania the period April 6-26 is about right. States south of Pennsylvania or equivalent areas would need to start earlier, and the most northerly areas of the United States and adjoining sections of southern Canada would start no earlier than the latter part of April.

3. Time of day to start the census.--The census data are collected during the evening period. The average male woodcock begins to "sing" at about ten to thirty minutes after sunset, depending on weather conditions. The period during which woodcock perform on their singing grounds varies from about twenty minutes to about forty-five minutes, averaging about thirty-five minutes in length. It would be most desirable for the first stop (or starting point) to be at a point where a woodcock is likely to be heard so that the starting time for any given evening's count may be accurately determined.

4. How to choose a starting point and interval stops.--Besides starting at a point where a woodcock is known to sing regularly, the starting point should be as distinct a land feature as possible, such as a railroad crossing, a culvert, a bridge, a crossroad, etc. Subsequent listening points should be no closer than four-tenths of a mile apart. Intervals between stops may be increased to the extent necessary to avoid nonwoodcock habitats or exceptional disturbances.

5. Number of times to make the counts.--Preliminary statistical studies of this census method indicate that it is preferable to run more routes once than fewer routes more than once. If, however, there is reason to believe that conditions were not normal on the night the route was run, it would be advisable to repeat the coverage another night as a check.

6. Making the count.--The "peent" call given by woodcock on the ground should be used for counting entirely, if possible, as being more reliable for separating different individuals. The flight song should only be resorted to if it can be definitely distinguished as a separate bird, or if disturbing noises such as frogs make it impossible to hear woodcock ground calls. Once the approximate starting time has been confirmed the census taker waits at the first stop until a woodcock is definitely heard calling on a known "singing ground." Check the time and wait there 2 minutes counting all different birds heard. However, since the first stop may not have a performing bird each evening, a certain amount of discretion must be used. The experienced census taker will know approximately what time his birds will start performing on a given evening. The suggested procedure, in case no bird is singing at the first stop, would be to wait 5 minutes after the latest expected commencement of song, then drive on to the second stop. Because of this, as well as other unpredictable points, it is almost essential that a census taker receive instruction from someone experienced with woodcock ground calls and flight songs before starting out "on his own." At the end of 2 minutes proceed as rapidly as possible to the next stop and listen there for 2 minutes, again counting all birds heard. Repeat this procedure over the entire route. If timing is correct (except on very short routes) the evening calling period should be practically over after the last 2 minutes of listening is completed.

7. Things to avoid.--Counts should not be made during the period of 2 days before a full moon and one day afterward (4 days in all), as it has been found the birds are very inconsistent in performing then. They should not be made in heavy rain or snow or when the temperature is below approximately 25 degrees or when a strong wind is blowing. A wind velocity of "Beaufort 3" (8-10 miles per hour, causing leaves and twigs to be in constant motion and light flags to be extended) is too strong. The best results will be obtained on warm, clear, quiet evenings.

#### V. Recording the Census Data

A standard form is provided for recording the pertinent data concerning your specific route and counts. For your convenience the attached sample data sheet (filled in) may help clarify the technique. Records should include: Date, weather (points circled on the form) including sky conditions and precipitation if any, temperature, wind, moon's phase, length of route, intervals between each stop, birds heard at each stop--combining both sides of the road (record 0 if no birds are heard), time of starting, and time of finishing. Space is supplied for recording data on the same route three different nights if it should be necessary to repeat the coverage for any reason. All data should be recorded on the forms furnished you. Please describe each area by definite local geographical boundaries (example: Black Hill Road, running 2.4 miles south from the

\ road leading to Brown's gravel pit). This exact description is needed in case of change in observers in subsequent years. It is recommended that a rough sketch made of your census route be drawn on the back of the data sheet unless the boundaries have obvious geographical markers shown on easily available maps. In case stop No. 1 (the start of the route) does not have a convenient geographical marker it may then be described as being a given number of tenths of a mile and a definite compass direction from a known marker. Indicate whether the route is exactly the same as that covered last year to aid the compiler.

#### VI. Reporting the Census Data

At the conclusion of census studies please return your forms directly to your local coordinator. Please make a special effort to meet his deadline date, otherwise the over-all compilation will be held up and the usefulness of your efforts impaired.

Remember this method of obtaining an index of abundance of woodcock is still in the experimental stage and your comments and suggestions will be welcome.

## WOODCOCK CENSUS COUNT

SAMPLE

State: Michigan

Year: 1955

County: Isabella

Observer: Irene F. Jorae

Town or Township: Chippewa

Observer's Address:

601 S. Arnold St.

Census route name or No: 2

Mt. Pleasant, Michigan

Same route used last year: Yes (No)

Details of Census route: Intersection of M-20, 7 miles east of Mt. Pleasant  
with road running north and south - south 3 miles.

Stop Number	Mileage from Stop No. 1	Number of Birds Recorded		
		1st Count	2nd Count	3rd Count
		Date: 4/21/55 Time at Start: 8:05 pm Time at Finish: 8:35 pm (Circle appropriate item below) Sky: (clear) 1/3 overcast; 2/3 overcast; overcast Temp.: (Deg.F.) 20-30; 31-40; 41-50; 51-60; 61+ Wind: calm; (light) gentle; moderate Moon: (none) 1/4; 1/2; 3/4; full Precipitation: (none) rain; snow	Date: Time at Start: Time at Finish: (Circle appropriate item below) Sky: clear; 1/3 overcast; 2/3 overcast; overcast Temp.: (Deg.F.) 20-30; 31-40; 41-50; 51-60; 61+ Wind: calm; light; gentle; moderate Moon: none; 1/4; 1/2; 3/4; full Precipitation: none; rain; snow	Date: Time at Start: Time at Finish: (Circle appropriate item below) Sky: clear; 1/3 overcast; 2/3 overcast; overcast Temp.: (Deg.F.) 20-30; 31-40; 41-50; 51-60; 61+ Wind: calm; light; gentle; moderate Moon: none; 1/4; 1/2; 3/4; full Precipitation: none; rain; snow
1	0.0	0		
2	.4	0		
3	.8	0		
4	1.2	1		
5	1.6	1		
6	2.0	1		
7	2.4	2		
8	2.8	0		
9	3.2	0		
10				
11				
12				
13				
14				
15				
16				
TOTAL		5		

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