A TWO-YEAR STUDY OF THE RING-NECKED PHEASANT (PHASIANUS COLCHICUS) ON THE 4-500-ACRE DANSVILLE, MICHIGAN STATE GAME AREA

Thesis for the Degree of M. S.

MICHIGAN STATE COLLEGE

Jack L. Cook

1954

This is to certify that the

thesis entitled

A Two Year Pheasant Study on the Forty-five Hundred Acre Dansville State Game Area

presented by

Jack London Cook

has been accepted towards fulfillment of the requirements for

M.S. degree in Zoology

George F. Wallace
Major professor

Date March 19, 1954.

A TWO-YEAR STUDY OF THE RING-NECKED PHEASANT (*Phasianus colchicus*) ON THE 4,500-ACRE DANSVILLE, MICHIGAN STATE GAME AREA

By

Jack L. Cook

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Submitted to the School of Graduate Studies of Michigan
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INTRODUCTION

Because the ring-necked pheasant (Phasianus colchicus) is a popular game bird in southern Michigan, factors influencing its welfare are of great interest to those who wish to see this species increase in numbers. The problem of just how to establish and maintain a pheasant population satisfactory to sportsmen and wildlife technicians has been and is highly controversial. Early efforts to increase populations were for the most part limited to hunting restrictions and releasing game-farm pheasants. Gradually research and experience have shown that, in most cases, if enough pheasants are released in a suitable habitat, the species will maintain itself without further releases. Research and experience have also indicated that pheasants will not survive if released in habitats that do not meet their specific requirements.

Since the introduction of the pheasant in North America, it has become increasingly evident that much of our game range does not meet the habitat requirements of the species. Some of these areas could, with a major change in habitat, become suitable pheasant range. Because such changes are seldom feasible, it is the first class and marginal pheasant range with which wildlife students and game management agencies are concerned. Good pheasant range is, of course, not a problem; such range serves as an example of what makes suitable pheasant habitat. In most cases all of the factors that make a certain area excellent pheasant range are not obvious, but are probably intangible combinations of varying

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proportions of common habitat situations such as weather, winter-cover relationship and the interspersion of adequate cover and food supplies. Before sound management of pheasant habitat can be undertaken, an inventory of the pheasant and its habitat resources must be made to determine, if possible, what requirements are lacking.

This paper presents such an inventory on a typical southern Michigan game area on submarginal land. An attempt has been made to evaluate pheasant and habitat resources with a view toward formulating management plans and hunting regulations. An effort has been made to draw conclusions that might be of value to a game technician from such routine sources as crowing cock censuses, summer brood counts, and hunting season data. In addition, a predator study and a study of released game-farm pheasants was made. These studies, though of limited scope, made it possible to draw some conclusions regarding their possible impacts on the pheasants. Whenever possible, these data from the Dansville area are compared to similar data from the Rose Lake Wildlife Experiment Station and to information from other similar study areas.

Acknowledgements

The author wishes to express his sincere thanks to Dr. George J. Wallace for his constant supervision, guidance and interest in the preparation of this paper.

Grateful acknowledgement is also due to Lee K. Nelson and L. L. Eberhardt for their aid in obtaining some of the crowing cock and pheasant brood data.

The writer appreciates the transportation to and from the study area furnished by the Game Division, Michigan Department of Conservation. Helpful suggestions and other aid by members of the Game Division and students of Michigan State College are also greatly appreciated.

Comparative data regarding pheasants on areas other than Dansville were taken from various Pittman-Robertson quarterly reports and records from the Rose Lake Wildlife Experiment Station.

DESCRIPTION OF THE DANSVILLE STATE GAME AREA

Location of the Dansville Game Area

The study was made on the 4,500-acre Dansville State Game Area (Fig. I) which is located in southcentral Ingham County, Michigan. The study area includes all or part of the following sections.

T1N,	R1E,	S2
"	"	S3
"	"	S4
"	"	S5
T2N,	R1E,	S26
"	"	S27
"	"	S28
"	"	S29
"	"	S30
"	"	S31
"	"	S32
"	"	S33
"	"	S34
"	"	S35

The study area is bounded by Dexter Trail on the north, Kelly Road on the northwest, Potter Road on the west, Ewers Road on the south and by Williamston Road on the east. Portions of the tract to the south and east of the above named boundaries were also included.

Method of Recording Place Locations

The method of recording place locations in the field, used in this study, was developed by Allen (1941). It consists of dividing up a section into 40-acre square plots.

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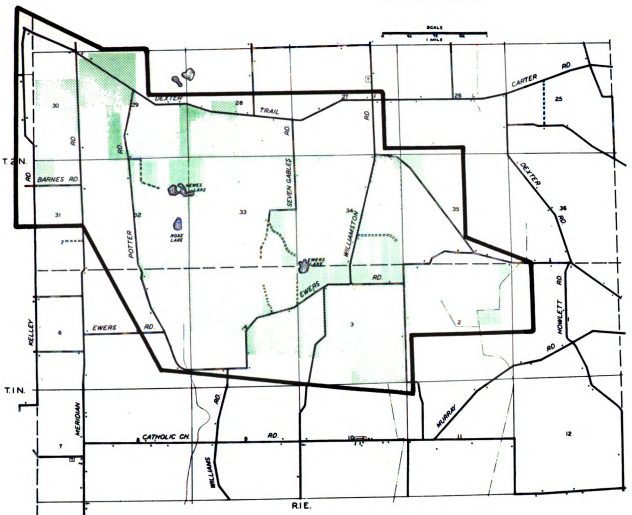
DANSVILLE STATE GAME AREA

INGHAM COUNTY

Figure I



BASE LEGEND

- HARD SURFACED ROAD
- GRAVEL ROAD
- GOOD DIRT ROAD
- POOR DIRT ROAD
- OCCUPIED HOUSE
- VACANT HOUSE
- SCHOOL HOUSE
- CHURCH
- CEMETERY

Boundary of Study Area

PUBLIC HUNTING GROUNDS

GA-52

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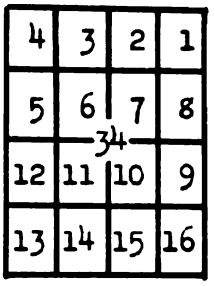
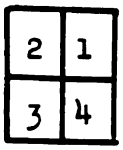
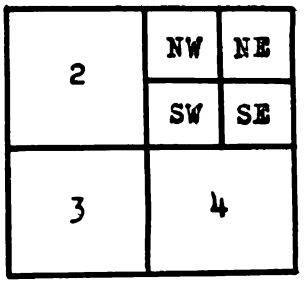


Each of the 40-acre divisions is further divided into 10-acre plots. For example:



Each of the 10-acre plots is divided into four 2½-acre plots which in turn are designated by compass points, NE, NW, SW and SE, as:



When designating a location in the field, the section number is given first, then a dash, followed by the number of the "forty", a dash followed by the 10-acre division number, and lastly, the directional divisions of the 10-acre plot. For example, in locating pheasant release #1, it would be written as: 34-5-2-SW. This would pin-point it within a 2½ acre plot. Such place designations are used throughout the study.

Topography

The Dansville area is characterized by small hills and ridges, small valleys, swampy basins and bog lakes. Ridges and slopes are greater in

area than level land. The forest cover of the upland is primarily oak-hickory (Quercus-Carya) with lesser amounts of elm (Ulmus), walnut (Juglans), and cherry (Prunus). Lowland species present are elm, aspen (Populus), swamp white oak (Quercus bicolor), and birch (Betula). Old farm sites that have not been cropped are gradually growing up to cherry, aspen, blackberries, and raspberries (Rubus). Marshes have characteristic growths of sedges (Carex, Cyperus, Scirpus), and rushes (Juncus).

The woodlots, cut over many years ago, are ungrazed and have understories of shrubs and herbs typical of this portion of Ingham County. A list of some of these is given in Table 6. See appendix page

The study area is of relatively low-value agricultural land. It was cleared during the period from 1830 - 1850. Fertility declined and land was farmed very little after 1920. The fertility was lost because of poor farming methods, the presence of steep slopes, stoniness, susceptibility to erosion, and lack of uniformity in soils and topography. Swamp woodlands make up a large section of the center of the area and are surrounded by uplands of grass, brushland and woodland. General farming and some dairying is practiced on most of the private land adjoining the study area.

Soils

The soil association is Bellefontaine, Hillsdale, Coloma, and Fox (Soil Survey of Ingham County, Michigan, U.S. Dept. Ag., 1941). The upland soils are primarily Oshtemo and Bellefontaine loamy sand with small islands of Fox, Hillsdale, Wallkill, Washtenaw, Miami, Bellefontaine and Brady sandy loams. The central portion of the game area has extensive

lowland of Carlisle muck and Rifle peat.

For the most part good pheasant range in Michigan has been correlated with areas of fertile soils (Blouch 1950, Ryder 1950, and Wight 1945). The foregoing description of the Dansville State Game Area would indicate that it is low quality pheasant range.

CROWING COCK CENSUS, 1949 AND 1950

Method and Techniques

The crowing cock census used at Dansville was based on findings by Kimball (1949), and on routine procedures developed by the Michigan Department of Conservation. The technique called for use of 8" x 5" cards and a small ruler or celluloid half circle marked off in degrees. When a crowing cock count was taken, a card was mounted on a clip board marked with the location, roads and other landmarks at the counting or listening station. The card was oriented to the station. Cock crows were counted for a two-minute period. During the following two-minute period the directions from which the crowing came were determined as accurately as possible and drawn on the card from the listening station point through the believed position of the crowing cock. A series of directional counts, taken on mornings having similar weather conditions, proved that even such rough plotting by ear was surprisingly consistent as to directions. Number of crowings, directions, weather conditions, station position and number were recorded on the cards. Directions and counts taken simultaneously from strategic positions were found to be more accurate than was at first supposed. The cards were used in the final plotting of cock territories.

At the beginning of the study 29 stations from approximately one-quarter to one-half mile apart were selected for crowing counts and to experiment with direction findings. The crowings were recorded during

the period from one-half hour before sunrise, till one hour after sunrise. Regardless of the time of starting, counts were taken for two minutes for a numerical record only. A lapse of three minutes was allowed and then another count, primarily for directional plotting, was taken for the next two minutes. Two-minute counts were taken every five minutes for one-half hour periods. After preliminary experimental records of crowing were made at pheasant release stations, numerical and directional counts were taken around the study area. These crowing records in conjunction with counts and directions taken at the release points, were used to plot in the crowing cock territories.

A map scale of six inches to one mile was used to plot in crowing directions from the several listening stations.

All cards were sorted as to listening stations and dates. The listening station location was found on the map. The angles of crowing directions were measured from the crowing data card with a protractor and transferred to the map. Directions were not transferred to the map unless they appeared on more than one card or had been close, clear and in agreement with all observations. After all directional data were transferred to the map, the points where directional lines crossed were considered possible crowing territory sites. Lines intersecting further than three-quarters of a mile apart were not included because opportunities for false locations were too great. In all cases, if a choice between intersecting lines had to be made the intersection involving the least distance was used. If a choice of a series of intersections was possible where the points of intersection were grouped in a small area, the most central intersection was used. One

directional line was not used more than once in plotting a potential crowing territory. The circles on the map (Fig. II) indicate the approximate location of each crowing area.

Comparison of Crowing Territories and Frequencies

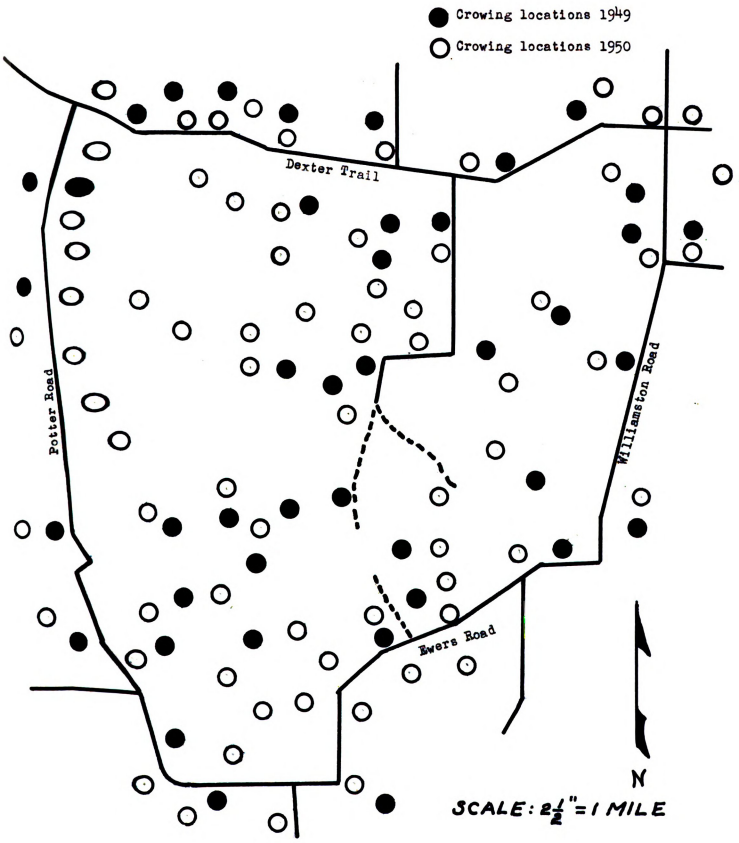
In 1949, 42 crowing territories were located by this method as compared to 70 territories in 1950, a build-up of 66 percent. In 1949, 28 cocks were observed on the crowing territories within an hour of the time the counts were taken, as compared to 42 in 1950. Cocks were observed in the vicinity of all of the crowing territories at some time during the spring of both years.

During April and early May 1949 and 1950, 310 two-minute crowing counts were taken at four locations on the Dansville area. See Fig. III.

Field notes indicated that wind interference was prevalent with velocities higher than 15 miles per hour and that crowing counts tended to be higher when the temperature was over 40°. Crowing counts listed in Table 1 (see also appendix Table 1) were averaged and the means placed in the following categories for comparison, i.e. counts taken at temperatures above 39° and below 40°, and counts taken when wind velocity was above 15 miles per hour and below 16 miles, as summarized in Table 2.

Figure II

Location of Crowing Territories
1949-1950



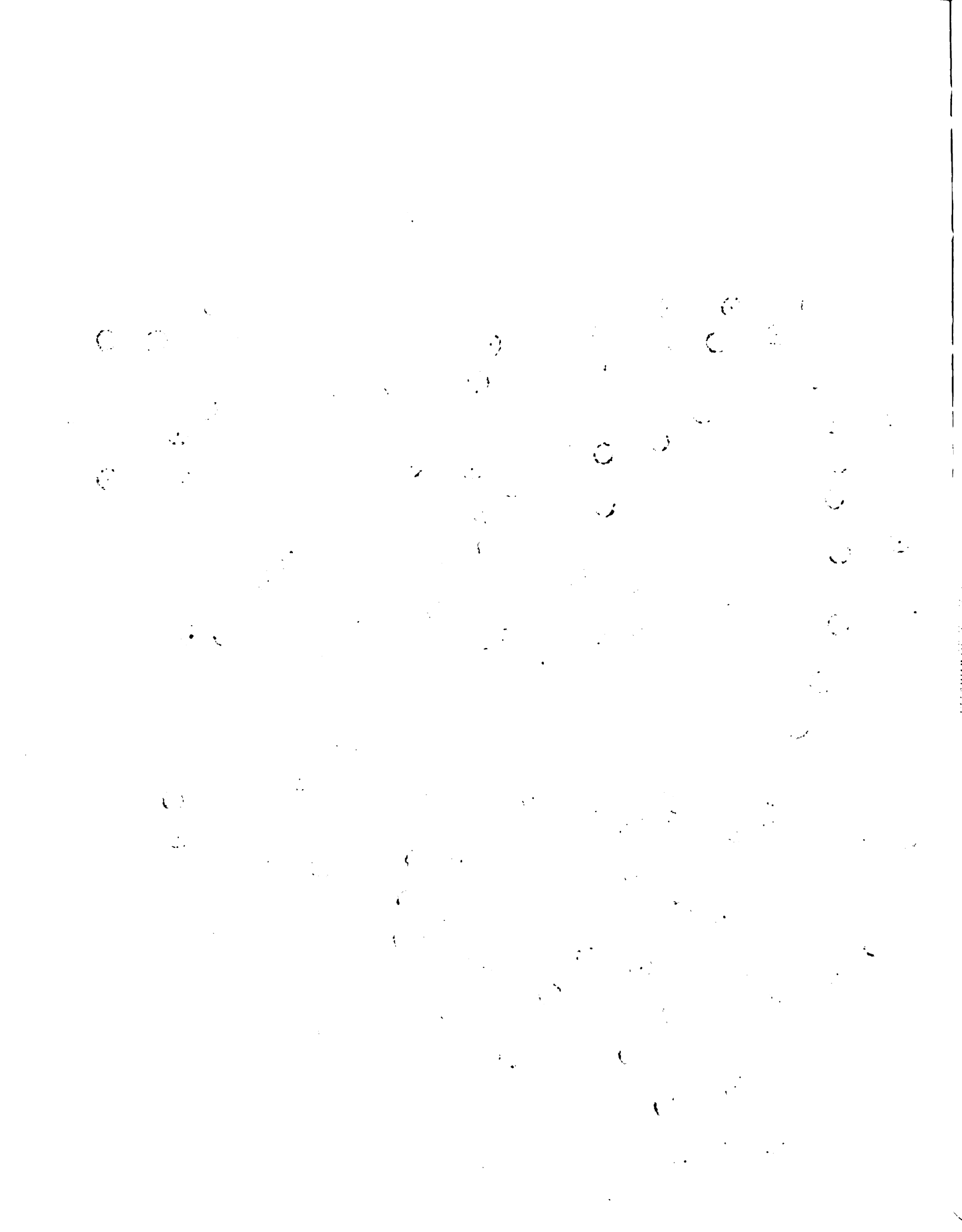


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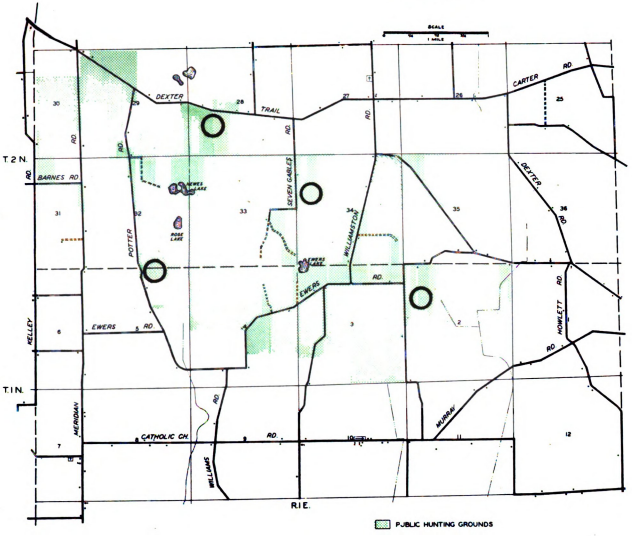
Figure III



BASE LEGEND

- HARD SURFACED ROAD
- GRAVEL ROAD
- GOOD DIRT ROAD
- POOR DIRT ROAD
- OCCUPIED HOUSE
- VACANT HOUSE
- SCHOOL HOUSE
- CHURCH
- CEMETERY

Sample Area for Crowing Counts and Pheasant Release Sites

GA-52

Corrected to 1953 ed.

TABLE 1

COCK CROWING DATA FROM
FOUR SAMPLE AREAS

Station	Location	Date	Sunrise	Wind & Temp.	Average Frequency	Notes
			Lienhart Road - Release Site #1 - 1949			
#1	2-5-4-NW	4-14-49	6:03 a.m.	NE 23 T-39°F	.8	Wind interference
#2	2-5-1-NW	4-14-49	6:03 a.m.	NE 23 T-39°F	2.1	Wind interference
			Lienhart Road - Release Site #1 - 1950			
#1	2-5-4-NW	4-19-50	5:52 a.m.	WSW 18 T-40°F	1.16	Fair listening
#2	2-5-1-NW	4-19-50	5:52 a.m.	WSW 16 T-46°F	1.8	Fair listening
			Dexter Trail - Release Site #2 - 1949			
#1	28-14-1-NW	4-12-49	6:05 a.m.	SE 11 T-42°F	3.8	Good listening
#1	28-14-1-NW	4-16-49	6:01 a.m.	W 20 T-27°F	1.1	Light snow at intervals. Sun visible through thin clouds. Wind interference.
#1	28-14-1-NW	5-14-49	5:33 a.m.	Negligible T-57°F	5.0	Excellent listening conditions. No wind interference. Some automobile interference.
#2	28-14-2-NE	4-12-49	6:05 a.m.	SE 11 T-42°F	3.6	Good listening
#2	28-14-2-NE	4-16-49	6:01 a.m.	W 14 T-28°F	1.6	Light snow at intervals. Sun Visible through thin clouds. Wind interference.

Station	Location	Date	Sunrise	Wind & Temp.	Average Frequency	Notes
			Dexter Trail - Release Site #2 - 1949			
#2	28-14-2-NE	4-17-49	6:10 a.m.	Negligible T-27°F	8.1	Good listening
#3	28-14-2-NW	4-16-49	6:01 a.m.	W 19 T-27°F	3.3	Light snow at intervals. Sky clearing. Wind interference.
#3	28-14-2-NW	4-20-49	5:57 a.m.	SW 11 T-37°F	10.5	Excellent listening
#3	28-14-2-NW	4-21-49	5:56 a.m.	SW 11 T-46°F	10.1	Excellent listening
#4	28-13-1-NW	4-17-49	6:00 a.m.	Negligible T-27°F	4.0	Good listening
#4	28-13-1-NW	4-20-49	5:57 a.m.	SW 16 T-37°F	4.6	Wind interfered somewhat at this station
#4	28-13-1-NW	5-14-49	5:33 a.m.	Negligible T-40°F	6.5	Excellent listening
			Dexter Trail - Release Site #2 - 1950			
#1	28-14-1-NW	4-23-50	5:45 a.m.	NE 12.5 T-44°F	5.3	Good listening
#1	28-14-1-NW	4-16-50	5:56 a.m.	WSE 12.9 Approx. T-32°F	5.0	Good listening
#1	28-14-1-NW	4-17-50	5:54 a.m.	W 16 T-54°F	6.8	A little wind interference
#2	28-14-2-NE	4-17-50	5:54 a.m.	W 16 T-56°F	10.1	A little wind interference
#2	28-14-2-NE	4-15-50	5:57 a.m.	WNW 11.5 T-25°F	3.0	Some wind interference
#2	28-14-2-NE	4-15-50	5:57 a.m.	WNW 11.5 T-28°F	3.5	Good listening

Station	Location	Date	Sunrise	Wind & Temp.	Average Frequency	Notes
			Dexter Trail - Release Site #2 - 1950			
#3	28-14-2-NW	4-25-50	5:42 a.m.	ENE 20 T-40°F	5.8	Some wind interference
#3	28-14-2-NW	4-25-50	5:42 a.m.	ENE 20 T-43°F	4.8	Some wind interference
#3	28-14-2-NW	4-27-50	5:39 a.m.	WSW 15 T-35°F	8.8	Good listening
#4	28-13-1-NW	4-27-50	5:39 a.m.	WSW 15 T-35°F	4.5	Fair listening
#4	28-13-1-NW	4-26-50	5:40 a.m.	SW 20 T-37°F	5.5	Some wind interference
#4	28-13-1-NW	4-26-50	5:40 a.m.	SW 20 T-37°F	6.2	
			Seven Gables - Release Site #3 - 1949			
#1	34-4-4-NW	4-14-49	6:03 a.m.	NE 23 T-40°F	5.1	Wind interference
#1	34-4-4-NW	4-16-49	6:01 a.m.	W 19 T-27°F	.5	Wind interference
#2	34-5-2-NW	4-14-49	6:03 a.m.	NE 23	3.1	Wind interference
#2	34-5-2-NW	4-16-49	6:01 a.m.	W 19 T-27°F	.7	Wind interference
			Seven Gables - Release Site #3 - 1950			
#1	34-4-4-NW	4-11-50	6:04 a.m.	W 30 T-41°F	5.3	Fair listening. Wind interference
#1	34-4-4-NW	4-12-50	6:02 a.m.	WNW 17 T-25°F	1.3	A little wind interference
#2	34-5-2-NW	4-11-50	6:04 a.m.	W 30 T-41°F	3.6	Only fair listening. Wind interference.
#2	34-5-2-NW	4-12-50	6:02 a.m.	WNW 17 T-25°F	1.2	A little wind interference

Station	Location	Date	Sunrise	Wind & Temp.	Average Frequency	Notes
			Potter Road - Release Site #4 - 1949			
#1	5-1-2-SW	4-12-49	6:05 a.m.	SE 10 T-40°F	7.2	Good listening
#1	5-1-2-SW	4-16-49	6:01 a.m.	W 18 T-27°F	.8	Wind interfered somewhat with good hearing
#2	5-2-1-NE	4-12-49	6:05 a.m.	SE 10 T-40°F	6.6	Good listening
#2	5-2-1-NE	4-16-49	6:01 a.m.	W 15 T-27°F	1.5	Wind interfered somewhat with good hearing
#2	5-2-1-NE	4-26-49	5:51 a.m.	W 20 T-60°F	.8	Wind interference
#3	32-16-3-NW	4-23-49	5:54 a.m.	W 30 T-46°F	4.3	Wind interference
#4	32-15-4-NW	4-23-49	5:54 a.m.	W 30 T-46°F	2.5	Wind interference
#5	32-16-2-NW	4-26-49	5:51 a.m.	W 25 T-60°F	.8	Wind interference
			Potter Road - Release Site #4 - 1950			
#1	5-1-2-SW	4-21-50	5:48 a.m.	W 11 T-35°F	7.0	Good listening
#1	5-1-2-SW	4-21-50	5:48 a.m.	W 11 T-36°F	6.8	Good listening
#2	5-2-1-NE	4-21-50	5:48 a.m.	W 11 T-39°F	5.8	Good listening
#2	5-2-1-NE	4-20-50	5:49 a.m.	W 16 T-37°F	2.6	Some wind interference
#2	5-2-1-NE	4-30-50	5:35 a.m.	ENE 15 T-40°F	15.7	

Station	Location	Date	Sunrise	Wind & Temp.	Average Frequency	Notes
			Potter Road - Release Site #4 - 1950			
#3	32-16-3-NW	4-30-50	5:35 a.m.	ENE 15 T-43°F	9.1	
#4	32-15-4-NW	4-29-50	5:36 a.m.	ENE 15 T-40°F	4.0	
#5	32-16-2-NW	4-29-50	5:36 a.m.	ENE 15 T-40°F	5.0	

TABLE 2

COMPARISON OF MEANS OF 310 CROWING COUNTS
TAKEN AT FOUR SAMPLE STATIONS

	1949				1950			
	Above 39°		Below 40°		Above 39°		Below 40°	
	Wind above 15 mph	Wind below 16 mph	Wind above 15 mph	Wind below 16 mph	Wind above 15 mph	Wind below 16 mph	Wind above 15 mph	Wind below 16 mph
All counts	2.7	6.1	1.7	5.1	4.5	7.8	3.3	5.9
Crowing counts taken later than ½ hour after sunrise	2.5*	4.1	1.4	1.6*	3.2	8.5	2.9	4.2
Counts taken ½ hour before to ½ hour after sunrise	2.8	7.6	2.7*	6.0	5.2	5.0*	4.1	7.7

*Insufficient data

In all categories except one, the percent increase in the 1950 crowing frequency over that of 1949 was substantial (Table 3); the exception was in a category having insufficient data to cause the digression to be considered significant.

TABLE 3

PERCENT INCREASE (OR DECREASE) IN AVERAGE NUMBER OF CROWINGS PER TWO-MINUTE INTERVALS IN 1950 OVER 1949

	Above 39°		Below 40°	
	Wind above 15 mph	Wind below 16 mph	Wind above 15 mph	Wind below 16 mph
All counts combined	66	24	94	16
Counts taken later than ½ hour after sunrise	22*	107	107	162*
Counts taken ½ hour before to ½ hour after sunrise	86	-34*	51*	28

*Insufficient data
-Percent decrease

A comparison of two-minute crowing counts taken above 39° and below 40° was made using the counts recorded on the sample areas. All categories with sufficient data show higher crowing frequencies when the temperature was above 39°. These comparisons are shown in Table 4.

TABLE 4

PERCENT INCREASE (OR DECREASE) IN CROWING PER TWO-MINUTE INTERVALS AT TEMPERATURES ABOVE 39° OVER THOSE BELOW 40°

	1949		1950	
	Above 39°		Above 39°	
	Wind above 15 mph	Wind below 16 mph	Wind above 15 mph	Wind below 16 mph
All counts combined	58	19	36	32
Counts taken later than ½ hour after sunrise	78*	156*	10	102
Counts taken ½ hour before to ½ hour after sunrise	3*	26	26	-35*

*Insufficient data
-Percent decrease

A comparison of two-minute crowing counts taken with wind below 16 miles per hour and with wind above 15 miles an hour was made using data from the sample areas. Crowing frequencies taken when the wind was below 16 miles per hour showed higher frequencies in all cases where sufficient data were available. The comparison of crowing frequencies taken with different wind velocities is summarized in Table 5.

TABLE 5

PERCENT OF INCREASE (OR DECREASE) IN CROWING PER TWO-MINUTE INTERVALS WITH WIND BELOW 16 MILES PER HOUR OVER COUNTS TAKEN WITH WIND ABOVE 15 MILES PER HOUR

	1949		1950	
	Above 39°	Below 40°	Above 39°	Below 40°
All counts combined	125	50	73	78
Counts taken later than ½ hour after sunrise	64*	14*	165	44
Counts taken ½ hour before to ½ hour after sunrise	171	122	-3.8*	87

*Insufficient data
—Percent decrease

During April and May of 1949 and 1950, 216 two-minute crowing counts were made at 29 stations on the study area. The counts were taken while directions used to locate crowing territories were being obtained. These data are listed in Table 6 (see Table 2 in appendix for complete data). Station locations are plotted in Fig. IV.

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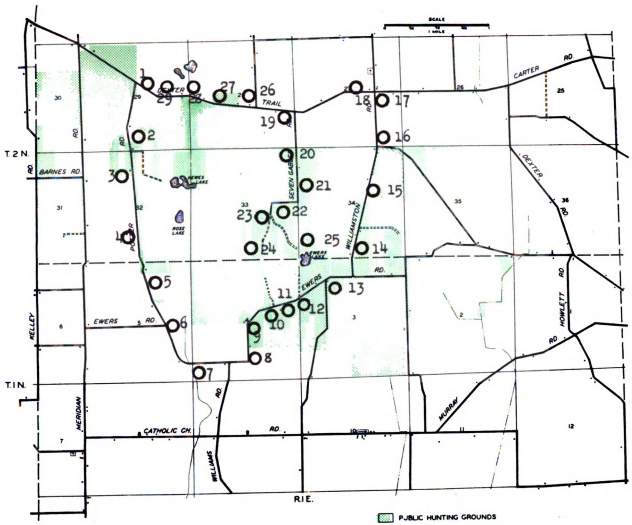
Figure IV

Location of 29 Listening Stations



O Listening Station

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TABLE 6

CROWING DATA FROM 29 LISTENING STATIONS, 1949 AND 1950

Date	Sunrise	Wind & Temp.	Average Frequency	Notes
		Station #1 - 1949		
4-28-49	5:38 a.m.	ENE 20 T-38°F	8.1	A little wind interference
4-26-49	5:40 a.m.	SSW 19 T-57°F	1	
		Station #1 - 1950		
5-5-50	5:28 a.m.	SE 23 T-54°F	9	A little wind interference
		Station #2 - 1949		
4-26-49	5:40 a.m.	SSW 20 T-59°F	3.5	
		Station #2 - 1950		
5-5-50	5:28 a.m.	SE 23 T-55°F	4	Some wind interference
		Station #3 - 1949		
4-26-49	5:40 a.m.	SSW 20 T-59°F	1.5	Wind interference
		Station #3 - 1950		
5-5-50	5:28 a.m.	SE 24 T-55°F	3.2	A little wind interference
		Station #4 - 1949		
5-31-49	5:03 a.m.	SW 11 T-59°F	3.2	
		Station #4 - 1950		
5-5-50	5:28 a.m.	SE 24 T-57°F	1.6	Wind interference

Date	Sunrise	Wind & Temp.	Average Frequency	Notes
		Station #5 - 1949		
4-26-49	5:51 a.m.	W 20 T-60°F	.8	Wind interference
4-23-49	5:54 a.m.	W 28 T-46°F	4.3	Wind interference
		Station #5 - 1950		
5-6-50	5:27 a.m.	WSW 30 T-58°F	3.8	Wind interference
5-6-50	5:27 a.m.	WSW 30 T-58°F	4.6	Wind interference
		Station #6 - 1949		
5-5-49	5:28 a.m.	SW 15 T-68°F	8	Fair listening
		Station #6 - 1950		
5-10-50	5:22 a.m.	W 18 T-47°F	8.5	A little wind interference
		Station #7 - 1949		
5-19-49	5:12 a.m.	S 18 T-67°F	8	
		Station #7 - 1950		
5-10-50	5:22 a.m.	W 18 T-47°F	7.5	A little wind interference
		Station #8 - 1949		
5-19-49	5:12 a.m.	S 21 T-67°F	7	A little wind interference
		Station #8 - 1950		
5-10-50	5:22 a.m.	W 18 T-47°F	9.5	Fair listening

Date	Sunrise	Wind & Temp.	Average Frequency	Notes
		Station #9 - 1949		
5-31-49	5:03 a.m.	SW 17 T-60°F	2.2	Good listening
		Station #9 - 1950		
5-10-50	5:22 a.m.	W 18 T-49°F	9	Fair listening
		Station #10 - 1949		
5-30-49	4:04 a.m.	S 10 T-50°F	4.8	Good listening
		Station #10 - 1950		
5-28-50	5:05 a.m.	N 8 T-49°F	6.6	Good listening
		Station #11 - 1949		
5-30-49	5:04 a.m.	S 10 T-55°F	5	Good listening
		Station #11 - 1950		
5-28-50	5:05 a.m.	N 8 T-49°F	6.6	Good listening
		Station #12 - 1949		
5-3-49	5:31 a.m.	SW 19 T-53°F	5	A little wind interference
		Station #12 - 1950		
5-2-50	5:32 a.m.	ENE 10 T-37°F	8.6	Good listening
		Station #13 - 1949		
5-3-49	5:31 a.m.	SW 16 T-51°F	4	Fair listening

Date	Sunrise	Wind & Temp.	Average Frequency	Notes
		Station #13 - 1950		
5-2-50	5:32 a.m.	ENE 10 T-37°F	8	Good listening
		Station #14 - 1949		
5-3-49	5:31 a.m.	SW 16 T-53°F	8	Fair listening
		Station #14 - 1950		
5-2-50	5:32 a.m.	ENE 10 T-37°F	9.7	Good listening
		Station #15 - 1949		
5-3-49	5:31 a.m.	SW 16 T-53°F	8	Good listening
		Station #15 - 1950		
5-4-50	5:29 a.m.	NE 11 T-55°F	12	Good listening
		Station #16 - 1949		
5-3-49	5:31 a.m.	SW 16 T-53°F	3	Fair listening
5-5-49	5:28 a.m.		1	Wind interference
		Station #16 - 1950		
5-4-50	5:29 a.m.	NE 11 T-55°F	9	Good listening
		Station #17 - 1949		
5-5-49	5:28 a.m.	SW 24 T-68°F	2.5	Car interference and a little wind interference
		Station #17 - 1950		
5-4-50	5:29 a.m.	NE 11 T-55°F	7.7	Good listening

Date	Sunrise	Wind & Temp.	Average Frequency	Notes
		Station #18 - 1949		
5-27-49	5:06 a.m.	WNW 13 T-43°F	1.2	
		Station #18 - 1950		
5-4-50	5:29 a.m.	NE 11 T-55°F	3.7	Good listening
		Station #19 - 1949		
4-28-49	5:38 a.m.	E 20 T-38°F	2.3	A little wind interference
5-5-49	5:28 a.m.	SW 24 T-68°F	5	Wind interference
		Station #19 - 1950		
5-28-50	5:24 a.m.	ESE 15 T-43°F	5	
		Station #20 - 1949		
4-28-49	5:38 a.m.	E 20 T-38°F	.66	A little wind interference
		Station #20 - 1950		
5-8-50	5:24 a.m.	ESE 15 T-43°F	7	
		Station #21 - 1949		
4-14-49	5:52 a.m.	ENE 21 T-40°F	5.1	
4-14-49	5:59 a.m.	ENE 21 T-40°F	3.3	A little wind interference
		Station #21 - 1950		
4-17-50	5:54 a.m.	W 16 T-54°F	6.8	A little wind interference
4-17-50	5:54 a.m.	W 16 T-56°F	6.8	A little wind interference

Date	Sunrise	Wind & Temp.	Average Frequency	Notes
		Station #22 - 1949		
4-28-49	5:38 a.m.	NE 20 T-38°F	1.3	A little wind interference
5-8-49	5:24 a.m.	NE 9 T-42°F	2.6	Good listening
		Station #22 - 1950		
5-12-50	5:19 a.m.	SW 14 T-49°F	6.3	Fair listening
		Station #23 - 1949		
5-7-49	5:25 a.m.	NE 19 T-49°F	0	A little wind interference
5-8-49	5:24 a.m.	NE 9 T-43°F	2.6	Good listening
		Station #23 - 1950		
5-12-50	5:19 a.m.	SW 14 T-49°F	2.6	Fair listening
		Station #24 - 1949		
6-1-49	4:03 a.m.	SE 17 T-54°F	2.6	A little wind interference
		Station #24 - 1950		
5-29-50	5:04 a.m.	ENE 8 T-59°F	6.6	Good listening
		Station #25 - 1949		
5-23-49	5:09 a.m.	SW 15 T-53°F	3.2	Fair listening
		Station #25 - 1950		
5-29-50	5:04 a.m.	ENE 8 T-59°F	5	Good listening

Date	Sunrise	Wind & Temp.	Average Frequency	Notes
		Station #26 - 1949		
5-23-49	5:09 a.m.	WSW 14 T-approx. 60°F	4.2	Good listening
		Station #26 - 1950		
5-23-50	5:09 a.m.	W 8 T-58°F	8.6	Good listening
		Station #27 - 1949		
5-28-49	5:05 a.m.	NNW 12 T-40°F	4	No interference
		Station #27 - 1950		
5-23-50	5:09 a.m.	W 8 T-58°F	10.3	No interference
		Station #28 - 1949		
4-28-49	5:38 a.m.	E 15 T-38°F	2.6	A little wind interference
		Station #28 - 1950		
5-7-50	5:25 a.m.	NNW 15 T-44°F	9	A little wind interference
		Station #29 - 1949		
5-23-49	5:09 a.m.	WSW 14 T-57°F	5.66	
		Station #29 - 1950		
5-25-50	5:42 a.m.	SSE 14 T-67°F	12	

Crowing counts listed in Table 6 were averaged and the means of these averages were placed in the following categories for comparison: counts made during 1949 and 1950, counts taken when wind velocity was above 15 miles per hour and when it was below 16 miles per hour. The counts at the 29 stations were taken at later dates than those on the sample areas and were made when temperatures were more uniform, most all of which were above 40°; therefore temperature was not considered a factor affecting crowing frequencies.

A comparison of crowing frequencies for the 29 stations is summarized in Table 7.

TABLE 7

A COMPARISON OF THE MEANS OF 216 TWO-MINUTE CROWING COCK COUNTS TAKEN AT 29 LISTENING STATIONS

	1949		1950	
	Wind above 15 mph	Wind below 16 mph	Wind above 15 mph	Wind below 16 mph
Counts taken ½ hour before to ½ hour after sunrise	3.4	4.42	7.7	7.6
Counts taken later than ½ hour after sunrise	3.8	4.07	5.1	6.6*
All counts combined	3.73	4.17	6.7	7.6

*Insufficient data

In the category of counts taken ½ hour before to ½ hour after sunrise the crowing frequencies were slightly higher with winds above 15 miles per

hour; however, in all other instances frequencies were higher when winds were below 16 miles per hour.

The percent of increases in crowing frequencies in 1950 over 1949 in all categories of crowing counts taken at the 29 stations is summarized in Table 8.

TABLE 8

PERCENT OF INCREASE IN AVERAGE NUMBER OF CROWINGS PER TWO MINUTES IN 1950 OVER 1949

	Wind above 15 mph	Wind below 16 mph
Counts taken ½ hour before to ½ hour after sunrise	126	73
Counts taken later than ½ hour after sunrise	34	65
All counts combined	81	80

A comparison of two-minute crowing counts taken with wind velocity below 16 miles per hour and above 15 miles per hour was made using crowing data from the 29 stations. Crowing frequencies taken when the wind was below 16 miles per hour were higher in all categories but one. A comparison of crowing frequencies taken with different wind velocities is summarized in Table 9.

TABLE 9

PERCENT OF INCREASE OR (DECREASE) IN CROWING PER TWO-MINUTE COUNTS WITH WIND BELOW 16 MILES OVER COUNTS TAKEN WITH WINDS ABOVE 15 MILES PER HOUR

	1949 Wind below 16 mph	1950 Wind below 16 mph
Counts taken ½ hour before to ½ hour after sunrise	29.0	-1.0
Counts taken later than ½ hour after sunrise	5.5	29.4
All counts combined	13.5	13.4

-Percent decrease

Crowing cock data from similar sample areas, such as The Rose Lake Wildlife Experiment Station and The Prairie Farm, are not available for comparison with the Dansville data for 1949 and 1950. However, statewide crowing data from 37 census routes run yearly by the Game Division showed an average 39 percent increase in crowing index over 1949. The crowing index is the highest average number of crowings for any one census run. Increases were as high as 136 percent. A few decreases were found. In 1950 the four sample areas had a 57 percent increase in crowing frequency whereas the 29 listening stations had a 99 percent increase. These increases were of all crowing averages. Census runs similar to those made by the Game Division were not made in this study. The greater increase of crowing frequency in the Dansville area might be

due to a faster build up of spring breeding populations in the less desirable areas caused by an overflow from more favorable surrounding pheasant habitat.

Pheasant records during the crowing cock study indicated that there was a lower sex ratio in the spring of 1950; however, the total breeding population was approximately twice as large (see Table 10).

TABLE 10

PHEASANT OBSERVATIONS AND SEX RATIOS
FOR SPRING 1949 AND 1950

Year	No. Cocks	No. Hens	Cocks & Hens	Sex Ratio
1949	42	66	108	64M:100F
1950	70	162	230	43M:100F

SUMMER BROOD STUDIES IN 1949 AND 1950

Methods

Brood observations were made while driving along roads during the early morning and late evening hours, and while cruising the area on foot. In 1949 observations were made while driving 462 miles and during two hundred hours of searching away from road areas on foot; in 1950 they were made with approximately the same search effort as in 1949. Dogs were used to help locate broods while searching on foot. A 20-power spotting scope and binoculars were utilized in determining brood size, sex and other details. Except for a few acres of open marsh the entire study area was searched for broods.

Observations farther apart than one-quarter of a mile were not considered to be of the same brood; those closer than one-quarter of a mile were separated by age of brood and by size.

Brood Observations

In 1949, 58 observations were made of 32 different broods. In 1950, 90 observations were made of 32 broods. A description of these follows:

Pheasant Brood Observations
Dansville State Game Area
1949

Brood No.	Date	Observations
1	June 12	Fourteen pheasant chicks, 3 weeks old.
2	June 28	Hen and 10 chicks 3 weeks old.
3	June 17	4:00 P.M. Hen and 10 chicks 3 weeks old in grass around abandoned farmyard. One cock and 2 hens observed in the immediate vicinity.
	Aug. 20	5:40 A.M. Two chicks 11 weeks old near abandoned farm house. One cock and 1 female flushed north to a small swamp.
4	June 18	7:00 A.M. Hen and 3 chicks 5 to 6 weeks old on roadside.
	June 21	7:30 A.M. Four chicks without hen, age 6 weeks.
5	June 18	7:00 P.M. Hen and 10 chicks 2 to 3 weeks old in grass at roadside.
	July 22	6:30 A.M. Hen and 3 chicks 5 to 6 weeks old at roadside.
	Aug. 28	6:20 A.M. One chick (cock), approximately 12 weeks of age, flushed into a clover field.
6	June 19	5:00 P.M. Hen and 10 chicks, 4 to 5 weeks old, at swamp edge. Another hen 50 feet from the brood.
	June 27	Eight chicks 5 weeks old with hen and cock at swamp edge.
	July 18	Cock and 10 chicks 7 to 8 weeks old observed flying north across Dexter Trail. The birds were followed and flushed from a hayfield. Cock appeared to be taking the place of the hen.

Brood No.	Date	Observations
7	June 19	5:10 P.M. Hen and 9 plus chicks, approximately 2 weeks old, at roadside and edge of a pasture and plowed field. Could not fly. One measured 8.5" shoulder to wing tip. All primaries and secondaries present.
	Aug. 26	Three 10 to 11 week old chicks in road. Ran into dense hedge.
8	July 20	6:30 P.M. Hen and 6 chicks approximately 5 weeks old flushed from idle field.
9	June 22	6:30 P.M. Hen and 3 chicks 5 to 6 weeks old in road.
	July 23	8:00 A.M. Hen and 10 chicks approximately 9 to 10 weeks old.
10	June 22	7:15 A.M. Nine chicks approximately 3 to 4 weeks old in field at roadside.
	July 13	4:30 P.M. Three chicks, no hen. Age approximately 6 weeks.
	July 28	7:00 P.M. Five chicks approximately 8 weeks of age in roadside near drainage ditch.
11	July 21	Three chicks 9 weeks of age.
12	June 25	7:00 P.M. Hen with metal band and 15 chicks 3 weeks of age were observed at roadside. One highway kill of same age collected by L. Eberhardt.
	June 29	6:45 A.M. Banded hen and 15 chicks 3 weeks old.
	July 28	11:30 A.M. Hen and 11 plus chicks 8 to 9 weeks old.
	Aug. 3	7:20 A.M. Ten plus chicks 9 to 10 weeks old, 3 identified as cocks. The birds were observed scattered out in a freshly mowed hayfield. When approached they flew in all directions. Maximum flight was about 200 yards.

Brood No.	Date	Observations
13	July 7	7:30 P.M. Hen and 7 chicks 6 weeks old crossing road.
14	July 11	8:30 A.M. Hen bearing yellow band #241 and 14 chicks 5 to 6 weeks old observed in brush at roadside, flushed to wheatfield.
	July 12	7:30 P.M. Four chicks 5 to 6 weeks old in road.
	July 22	6:00 P.M. Hen with yellow band and 13 chicks 6 to 7 weeks old flew into wheatfield.
	July 26	Fifteen chicks 8 weeks old in wheatfield edge.
	July 28	Three chicks approximately 8 weeks old observed flying from a large elm tree into wheatfield. A wet morning.
15	July 12	4:30 P.M. Hen and 4 chicks 7 weeks old in edge of an alfalfa field.
	Aug. 9	10:00 A.M. Hen and 3 chicks approximately 8 weeks old flushed from roadside, flew about 250 yards into cornfield.
	Aug. 15	7:30 P.M. Two chicks 8 to 9 weeks old flushed from roadside. Flew into hedgerow north of the road.
16	July 22	6:00 A.M. Four chicks 4 to 5 weeks old flushed from road to grain field.
17	July 22	6:30 A.M. Hen and 16 chicks 9 weeks old. Hen was banded on left leg with a red celluloid band. Nine male chicks and 7 female. This brood was followed for 45 minutes until all birds dispersed into the marsh. This might be a combination of broods.
	July 25	8:30 A.M. Twelve plus chicks 9 to 10 weeks old in road. Males turning red. Seven males and 5 females.

Brood No.	Date	Observations
	Aug. 15	Twenty-two chicks approximately 11 weeks old, easily distinguishable as to sex. Nine cocks, no hen, at least not observed.
	Aug. 17	8:30 A.M. Four chicks, 11 weeks old. Two cocks and 2 hens observed in road.
		9:00 A.M. Three chicks, 2 cocks and 1 female 11 weeks old observed in woods edge, flushed south across road on approach.
18	July 23	Hen and 8 chicks approximately 8 weeks old observed in the road.
	Aug. 11	Hen and 9 chicks 9 to 10 weeks old. Four cocks and 5 hens flushed about 50 yards north of road near low area surrounding Ewers Lake. They dispersed in all directions.
19	July 26	5:30 A.M. Six chicks approximately 7 weeks old observed in farmyard.
20	July 26	Hen and 12 plus chicks observed by a farmer in the area. Age of chicks estimated at 6 to 8 weeks.
21	July 27	Hen and 10 plus chicks observed by farmer in his barnyard. Age approximately 1 to 2 weeks old.
22	July 14	A pheasant nest under observation by Mr. Mac Cabe contained 15 eggs. Thirteen were hatched on the 14th of July and left the nest. The hen and brood have not been observed in the area since. Two unhatched eggs were destroyed later by some animal.
23	July 20	Eleven plus chicks approximately 7 to 8 weeks old and hen were observed crossing the Williamston Road.
24	July 28	Four chicks about 10 weeks old, one male and 3 hens were observed for 15 minutes, flushed into roadside swamp.

Brood No.	Date	Observations
25	Aug. 3	10:30 A.M. Four chicks approximately 8 weeks old observed in apple trees adjacent to abandoned farmyard. These pheasants flushed to a hedgerow approximately 50 yards from the orchard.
26	Aug. 5	8:20 A.M. Eight chicks, 5 males and 4 females 10 to 11 weeks old. Cocks easily discernible observed at roadside, followed the brood to the east over an embankment. The brood flushed and dispersed in a dense woods.
27	Aug. 17	Hen, no band, and 17 chicks 11 to 12 weeks old observed 200 yards east of Ewers Road feeding along edge of cornfield. Before the brood could be approached, a farm dog flushed the birds into the cornfield, at least 3 of the brood were cocks.
	Aug. 28	7:25 A.M. Eleven plus chicks 11 to 12 weeks old feeding east of Ewers Road. Birds fed in stubble for 20 minutes. Five of the chicks were identified as cocks.
28	Aug. 20	6:10 A.M. Two chicks, 1 cock and 1 hen 10 to 11 weeks old observed in road. Flushed to a garden near a farmyard.
	Aug. 23	7:05 A.M. Six chicks 10 to 11 weeks old. Two identified as cocks. Observed in hayfield, followed for 45 minutes. The chicks kept ahead of the observor, gradually dispersed in woods after becoming nervous at too close approach.
29	Aug. 22	7:00 A.M. Observed hen, blue celluloid band on right leg and aluminum band on left leg, with brood of 6 chicks 8 to 9 weeks old. Brood crossing road into swamp from west to east. Attempted to follow but lost brood in dense vegetation.
30	Aug. 26	9:00 A.M. Three plus chicks. No hen. Two cocks and 1 hen positively identified as to sex, 8 to 9 weeks old. Observed in middle of pasture, when first observed brood was entering a patch of corn adjoining a woods.

Brood No.	Date	Observations
31	Aug. 26	8:40 A.M. Observed lone cock, chick in road 12 weeks of age. No sign of brood mates were seen. The bird flushed into adjoining swamp.
32	Aug. 28	10:30 A.M. Observed a large brood 13 plus chicks, 10 to 11 weeks of age flying from edge of buckwheat field south into swamp.[1]

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[1]The observation was not made near enough to the flushing point to determine exact number or sex. Evidence of the presence of more than 1 brood in this area has been seen during the summer in the form of pheasant tracks and from observation of a State Game Farm employee. The extreme density of the cover and the nature of the surroundings have made observations in this immediate area very difficult.

Miscellaneous Observations

Adult Cocks: Two adult cocks fighting at south margin of freshly plowed field, now a buckwheat field. The cocks fought for about two minutes, then one drove the other northeast across field to a hedgerow. When the pursued cock reached the hedgerow, the pursuer ran back to the swamp.

Relationship to other animals: On four occasions pheasant chicks were seen sporting with young rabbits, each time early in the morning. The chicks would jump at the rabbit. The rabbit would kick at and hop away from the chicks.

Mortalities: On June 25, Brood No. 12, one highway mortality.

On June 29, Brood No. 24, one highway kill, cock 10 weeks old.

On August 28 at Seven Gables Road by old barn north of Release Site #1, an immature Marsh Hawk was observed flying into a tree on west side of road in front of the barn. The hawk seemed reluctant to leave its perch, and upon investigation a pheasant chick was found at the spot from which the hawk had been flushed. The chick was still warm. Its head was missing, the wings had been partly plucked and a two and one-half inch hole had been made from under the right wing into the viscera. It was raining and no cars had passed on the road. No observation of a brood this age in the vicinity has been recorded.

June 28: a hen, Band No. 102 yellow celluloid, alluminum Band No. 118789, April release, was found on Meridian Road 500 feet from State Highway 36, killed by a car.

Cock Crowing: Two different cocks were heard crowing on Seven Gables Road near Release Site #1, and southwest of Release Site #1 at 7:30 A.M., June 16. These were the only crowing cocks heard during June, July and August 1949.

Estimated Hatching Period of Broods Observed
on The Daneville State Game Area - 1949

Brood	Approximate Hatching Period	Approximate Incubation Period
1	May 29 - June 4	May 5 - May 28
2	June 5 - June 11	May 16 - June 8
3	May 22 - May 28	May 2 - May 25
4	May 15 - May 21	April 25 - May 18
5	May 29 - June 4	May 6 - May 29
6	May 15 - May 21	April 22 - May 15
7	June 5 - June 11	May 12 - June 5
8	June 12 - June 18	May 24 - June 12
9	May 15 - May 21	April 28 - May 15
10	May 29 - June 4	May 7 - May 29
11	May 15 - May 27	April 26 - May 15
12	June 5 - June 11	May 12 - June 5
13	May 22 - May 28	May 3 - May 22
14	May 29 - June 4	May 8 - June 2
15	May 22 - May 28	April 29 - May 24
16	June 19 - June 25	May 30 - June 22
17	May 15 - May 21	April 24 - May 18
18	May 22 - May 28	May 3 - May 27
19	June 5 - June 11	May 15 - June 8
20	June 5 - June 11	May 15 - June 8
21	July 17 - June 23	June 23 - July 17
22	July 14 by actual observation	June 21 - July 14

Brood	Approximate Hatching Period	Approximate Incubation Period
23	May 29 - June 1	May 5 - May 29
24	May 15 - May 21	April 26 - May 15
25	June 5 - June 11	May 14 - June 5
26	May 22 - May 28	May 1 - May 24
27	May 22 - May 28	April 30 - May 23
28	June 5 - June 11	May 16 - June 8
29	June 19 - June 25	May 30 - June 22
30	June 26 - July 2	June 6 - June 28
31	May 29 - June 4	May 8 - June 1
32	June 12 - June 18	May 24 - June 16

Other vertebrates observed while making the brood study were:

Sylvilagus floridanus mearnsii (Cottontail Rabbit)-186

Sciurus niger (Fox Squirrel)-6

Vulpes fulva (Red Fox)-1

Odocoileus virginianus (White-tail Deer)-2

Colinus virginianus (Adult Bob-white)-23

Bob-white hen and 12 chicks

Circus cyaneus (Marsh Hawk)-19

Accipiter cooperii (Cooper's Hawk)-2

Buteo jamaicensis (Red-tailed Hawk)-26

Buteo lineatus (Red-shouldered Hawk)-8

Accipiter striatus (Sharp-shinned Hawk)-2

Thamnophis sp. (Garter Snake)-3

Coluber constrictor (Blue Racer)-18

Brood Sizes - 1949

1. Average brood size for each observation based on 58 records was 7.87 chicks.

2. Average size of complete broods based on 21 observations was 10.4.

3. Average brood size for all observations:

   a. One-quarter grown, 1 to 3 weeks old: 11.7 chicks per brood based on 9 observations.

   b. One-half grown, 3 to 6 weeks old: 6 chicks per brood based on 13 observations.

   c. Three-quarters grown, 6 to 9 weeks old: 7.5 chicks per brood based on 18 observations.

4. Average size of complete broods by one-quarter grown, one-half grown, three-quarters grown and full grown:

   a. One-quarter grown, 1 to 3 weeks old: 12 chicks per complete brood based on 6 observations.

   b. One-half grown, 3 to 6 weeks old: 10.2 chicks per complete brood based on 4 observations.

   c. Three-quarters grown, 6 to 9 weeks old: 10.3 chicks per complete brood based on 8 observations.

   d. Full grown, 10 to 12 weeks old: 9.2 chicks per complete brood based on 8 observations.

Sex Ratio in Broods Where The Sex was Distinguishable

Brood No.	Male	Sex Ratio	Female
3	1		1
17	9		13
24	1		3
26	5		4
18	4		5
28	1		1
7	1		2
TOTAL	22	1M:1.3F	29

Brood Sizes - 1950

1. Average brood size for each observation based on 90 records was 6.0 chicks.

2. Average size of complete broods based on 36 observations was 9.9 chicks.

3. Average brood size for all observations:

   a. One-quarter grown, 1 to 3 weeks old: 5 chicks per brood based on 2 observations.

   b. One-half grown, 3 to 6 weeks old: 4.4 chicks per brood based on 13 observations.

   c. Three-quarters grown, 6 to 9 weeks old: 5.75 chicks per brood based on 37 observations.

   d. Full grown, 9 to 16 weeks old. Average 7.3 chicks per brood based on 38 observations.

4. Average size of complete broods by one-quarter grown, one-half grown, three-quarters grown and full grown:

   a. One-quarter grown, 1 to 3 weeks old: 8 chicks per complete brood based on 1 observation.

   b. One-half grown, 3 to 6 weeks old: 8 chicks per complete brood based on 3 observations.

   c. Three-quarters grown, 6 to 9 weeks old: 10.2 chicks per complete brood based on 12 observations.

   d. Full grown, 10 to 12 weeks old: 10.2 chicks per complete brood based on 20 observations.

A summary of brood observations is presented in Tables 11 and 12.

Brood locations are shown in Figures V and VI.

TABLE 11

COMPARISON OF ALL BROOD OBSERVATIONS

Age	1949	1950
Average brood size per observation	7.9	6.0
" " " " complete brood	10.4	9.9
" " " " one-quarter grown	11.7	5.0
" " " " one-half grown	6.0	4.4
" " " " three-quarters grown	7.5	5.7
" " " " full grown	7.1	7.3
Lone hens	8.0	12.0

TABLE 12

COMPARISON OF OBSERVATIONS OF COMPLETE BROODS

Age	1949	1950
Average brood size per one-quarter grown	12.0	8.0
" " " " one-half grown	10.2	8.0
" " " " three-quarters grown	10.3	10.2
" " " " full grown	9.2	10.2*

*Believed due to combining of broods

MICHIGAN
DEPARTMENT OF CONSERVATION
GAME DIVISION

DANSVILLE STATE GAME AREA

INGHAM COUNTY

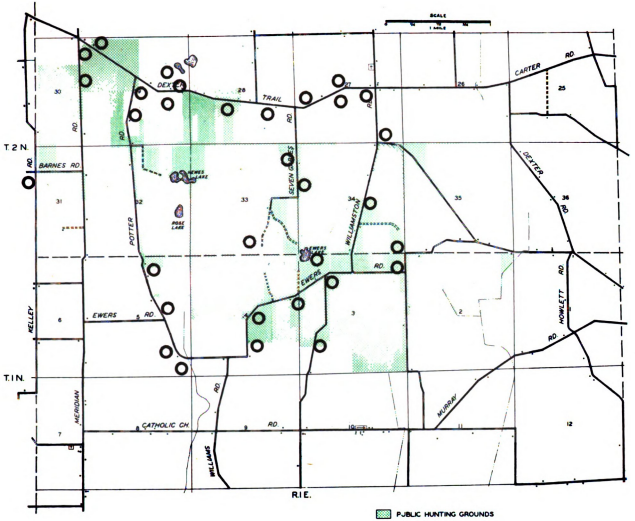


Figure V

Locations of 32 Pheasant Broods Observed During June, July and August of 1949

BASE LEGEND

- HARD SURFACED ROAD
- GRAVEL ROAD
- GOOD DIRT ROAD
- POOR DIRT ROAD
- OCCUPIED HOUSE
- VACANT HOUSE
- SCHOOL HOUSE
- CHURCH
- CEMETERY

O Brood Location

GA-52

Corrected By 53 7-49

48

MICHIGAN
DEPARTMENT OF CONSERVATION
GAME DIVISION

DANSVILLE STATE GAME AREA

INGHAM COUNTY

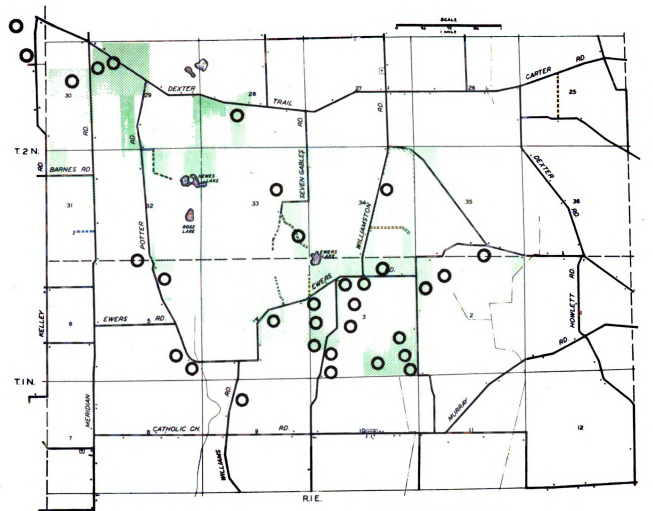


Figure VI

Locations of 32 Broods Observed during June, July and August of 1950 by L. Eberhardt, D. Ramsay and J. Cook

BASE LEGEND

- HARD SURFACED ROAD
- GRAVEL ROAD
- GOOD DIRT ROAD
- POOR DIRT ROAD
- OCCUPIED HOUSE
- VACANT HOUSE
- SCHOOL HOUSE
- CHURCH
- CEMETERY

Brood Location

GA-52

Hatching Dates

Hatching dates for the two years were estimated from brood observations and from age determination (by primary wing-molt) of pheasants of the year killed during hunting season. A comparison of hatching dates for the two years follows in Table 13.

TABLE 13

APPROXIMATE HATCHING DATES OF DANSVILLE BROODS - 1949 AND 1950

Date	1949	1950
May 7-13		
14-20	6	
21-27	6	2
28-June 3	6	3
4-10	7	7
11-17	2	2
18-24	2	8
25-July 1	1	2
2-8	0	4
9-15	1	2
16-22	1	
23-29		
30-Aug. 5		2
TOTALS	32	32

A graphic comparison of the distribution of the 1949 Dansville hatching dates as determined by wing-molt and brood data appear in Fig. VII.

Hatching distribution of Prairie Farm pheasants is summarized in Table 15 and shown graphically in Fig. VIII. Hatching distribution from 1950 brood data from the Prairie Farm and Dansville are shown graphically in Fig. IX and summarized in Table 16.

TABLE 14

HATCHING DATES OF DANSVILLE PHEASANT BROODS
1949-1950

Date	1949 Sight Records	1949 Hunting Season Wing-Molt*	1950 Sight Records
May 7-13			
14-20	6	5	
21-27	6	12	2
28-June 3	6	11	3
4-10	7	12	7
11-17	2	7	2
18-24	2	6	8
25-July 1	1		2
2-8		4	4
9-15	1	3	2
16-22	1		
23-29			
30-Aug. 5		2	2
6-12			
TOTALS	32	62	32

*Data taken from notes of L. L. Eberhardt

TABLE 15

HATCHING DATES OF PRAIRIE FARM PHEASANT BROODS
1949-1950*

Date	1949 Sight Records	1949 Hunting Season Wing-Molt	1950 Sight Records
May 7-13			
14-20		2	
21-27		11	
28-June 3		30	
4-10	3	29	1
11-17	6	18	2
18-24	14	13	8
25-July 1	6	6	5
2-8	1	2	5
9-15		7	5
16-22		3	
23-29		1	
30-Aug. 5		5	1
6-12			
TOTALS	30	127	27

*Prairie Farm data taken from field notes of L. L. Eberhardt

TABLE 16

SOME PHEASANT BROOD HATCHING DATES - 1950

Date	Prairie Farm*	Dansville	Fennville*	Tuscola Co.*	Ingham Co.*
May 7-13					
14-20					
21-27		2			
28-June 3		3	1	1	1
June 4-10	1	7	3	3	
11-17	2	2	4	6	11
18-24	8	8	7	9	10
25-July 1	5	2	7	11	9
July 2-8	5	4	2	4	2
9-15	5	2		1	2
16-22					1
23-29			1		
30-Aug. 5	1	2			
6-12			1		
TOTALS	27	32	27	35	36

*Data taken from field notes of L. L. Eberhardt

Figure VII

Comparison of Dansville Hatching Distributions

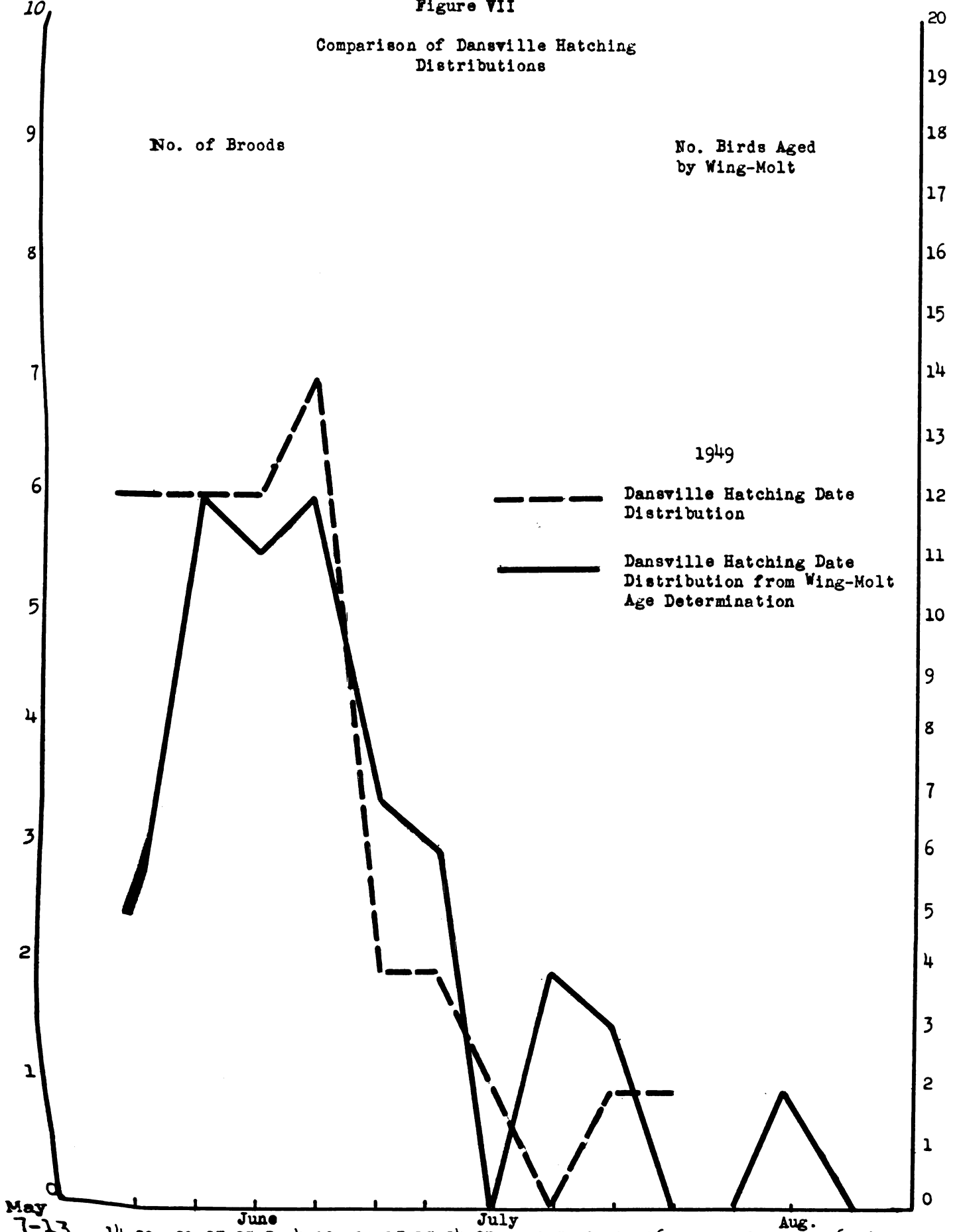


Figure VIII

Comparison of Prairie Farm
Hatching Distributions

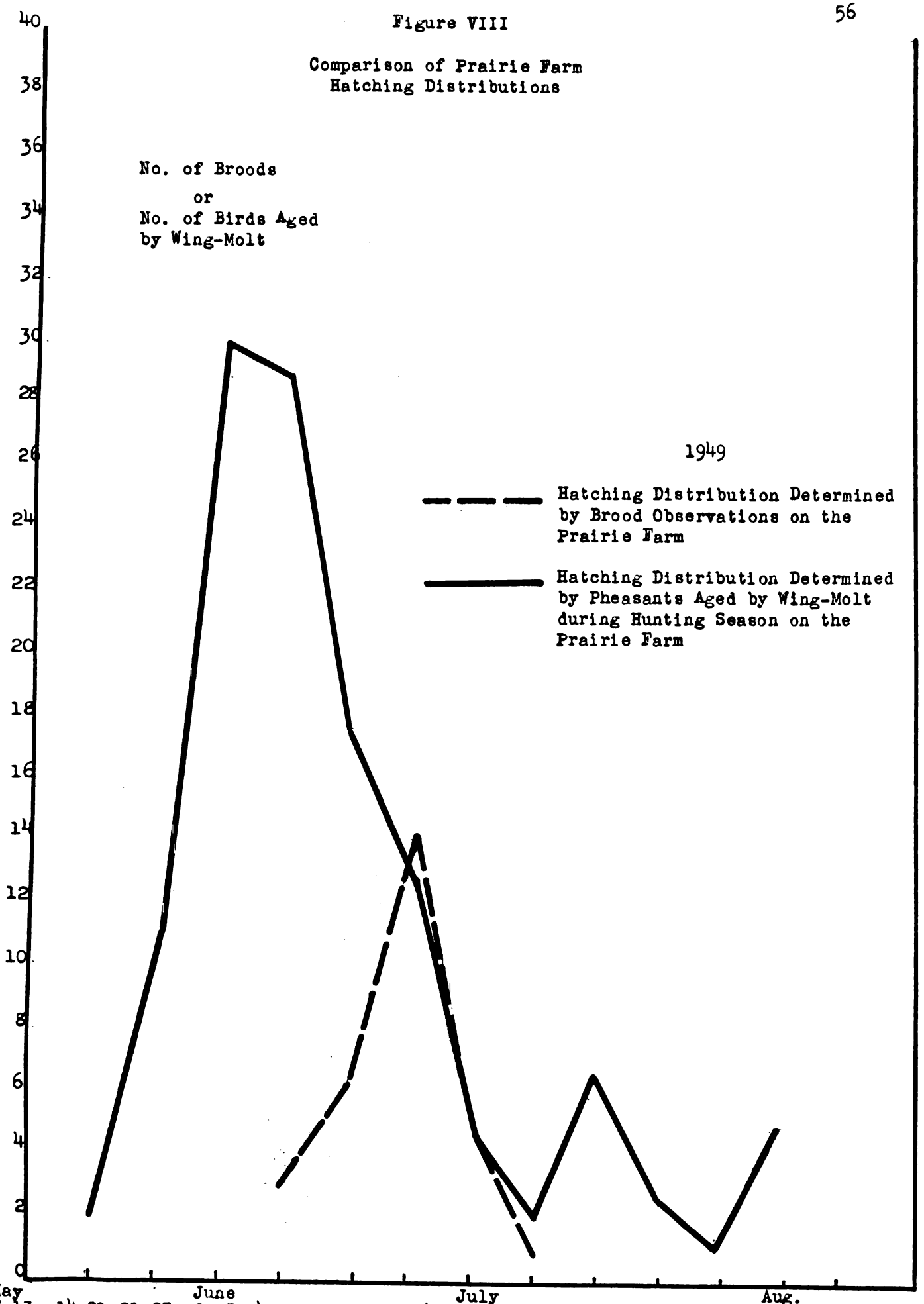
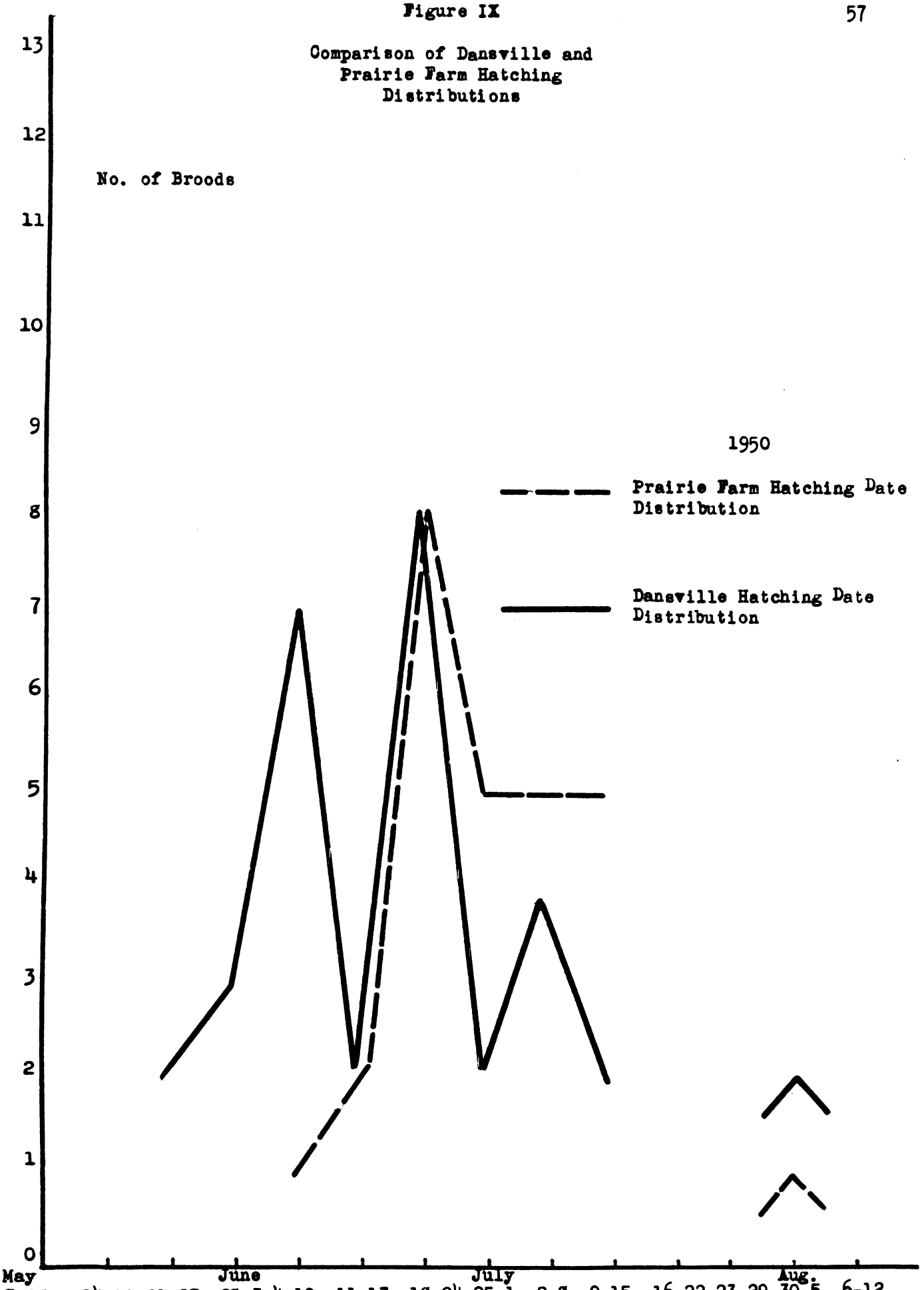


Figure IX

Comparison of Dansville and Prairie Farm Hatching Distributions



No definite trend in brood size was evident for either year, however, in 1949 the size of complete broods tended to get smaller as the season progressed. This trend was reversed in 1950 when size of complete broods grew larger.

The 1949 data from the Dansville area show a peak in hatching during the first week in June (Fig. VII). Age data from field observation of broods and from wing-molt age determinations are in approximate agreement as to hatching distribution up to July.

In 1949 brood data from the Prairie Farm show a peak in hatching about two weeks later than Dansville. Ages determined from wing-molt stage coincides with the June 4-10 hatching peak at Dansville and agrees with the second small peak in hatching July 9-15 (see Fig. VIII).

PHEASANT HUNTING SEASON STUDIES

1949 AND 1950

Method of Study

During the 1949 pheasant season the Dansville State Game Area was checked by five Michigan State College wildlife management students. Transportation, interview forms and authority were furnished by the Game Division of the Department of Conservation. During mornings two check stations were maintained on main exit routes while three workers patrolled the area interviewing hunters and examining their bag. In the afternoon, with more hunters leaving, four checking stations were maintained. It was estimated that 80 percent of the hunters were interviewed. Hunters were asked about game taken, game observed, and their opinion of hunting conditions and game abundance as compared with the previous year.

Pheasants were examined as to length of bursa of fabricius, if present, to determine birds of the year. The length of spur was measured as juvenile spurs are usually under 12 mm. in length and adult spurs over 13 mm. The length of the newest primary was measured on juvenile pheasants for this measurement will give their age in weeks. Most of the juvenile birds taken during the Michigan hunting season are from 16 to 26 weeks old.

After the close of the pheasant season, 38 farmers living adjacent to the Game Area were interviewed. Persons interviewed gave information

regarding the location where pheasants were bagged, when they were taken and other pertinent information.

During the 1950 pheasant hunting season two checking stations were maintained at exit road intersections each day by college students working part time for the Game Division. Approximately 75 percent of those hunting on the area were interviewed. Information requested was the same as that in 1949. Farmers living adjacent to the Game Area were not interviewed in 1950.

Comparison of the 1949 and 1950 Pheasant Seasons

Hunting season data show a 65 percent increase in the number of hunters in the 22-day 1950 pheasant season over the 16-day season in 1949. During the longer 1950 season the number of hours hunted was 68 percent higher than in 1949, 20 percent fewer wild pheasants were taken. Sixty-four banded pheasants were taken in 1949, while 71 banded birds were bagged in 1950. Because pheasants were released before each year's hunting season in varying amounts and at different times, the released pheasants taken will be considered separately in the section on released pheasants.

In 1949, 3.5 pheasants were bagged per 100 gun hours whereas in 1950 only 1.7 pheasants were taken for the same effort. The decrease in hunter success was probably due to the 68 percent increase in effort at a location where the game supply was approximately the same. Hunting season data are summarized in Tables 17 and 18.

TABLE 17

DANSVILLE HUNTING SEASON DATA BY WEEKS
1949 AND 1950

Year	1st Week End				2nd Week End				3rd Week End				4th Week End				All Season			
	No. hunters	Hours hunted	Pheasants taken	Gun hours per bird	No. hunters	Hours hunted	Pheasants taken	Gun hours per bird	No. hunters	Hours hunted	Pheasants taken	Gun hours per bird	No. hunters	Hours hunted	Pheasants taken	Gun hours per bird	No. hunters	Hours hunted	Pheasants taken	Gun hours per bird
1949	356	1126	89*	12.6	242	861	47*	18.3	110	318	10*	32	Closed Season				708	2305	146*	15.8
1950	574	1934	96*	20.0	364	1,151	25*	46.0	100	297	4*	74.3	133	497	11*	45.1	1,171	3879	136*	28.5
1949	(banded)		40				22				2		Closed Season							
	(wild)		49				25				8									
1950	(banded)		61				8				0				2					
	(wild)		35				17				4				9					

*Contains some released game-farm pheasants

TABLE 18

HUNTING SEASON DATA

Year	No. Hunters	Hours Hunted	Pheasants Taken Wild	Pheasants Taken Banded	Pheasants Observed Cocks	Pheasants Observed Hens	Hours Per Bird	Birds Per 100 hrs.	Birds Per Hunter
1949	708	2,305	82	64	333	339	28	3.5	.115
1950	1,171	3,879	65	71	600	581	60	1.7	.055

Other things being equal the amount of game observed on the same area per unit of hunting effort during different years is a fair indicator of relative population densities. During the 1949 pheasant season 29 pheasants were observed for each 100 hours of hunting, whereas 30 pheasants per 100 hours effort were seen in 1950. The observation of about the same number of pheasants each year is an indication that approximately the same number were available to hunters both years. Pheasant observations for the two hunting seasons are summarized in Table 19.

TABLE 19

HUNTING SEASON PHEASANT OBSERVATIONS
1949 AND 1950

	Cocks	Hens	Sex Ratio	Observed per 100 hours	Cocks and Hens
1949	333	339	98M:100F	29	672
1950	600	581	103M:100F	30	1181

It is supposed that the ratio of adult to juvenile pheasants in any given year is a good indicator of production of young that year. No age data are available from Dansville in 1950; however, Ingham County data taken from Conservation Department files show a hunting season age ratio of 12 juveniles to one adult. Because Ingham County, as a whole, is fair pheasant habitat while Dansville is relatively poor, the age ratio for 1950 was probably somewhat lower, possibly around 8 or 9 juveniles to one adult. In 1948 the Dansville hunting season age ratio was 1.25 juveniles to one adult, indicating very poor reproduction. In 1949 the hunting season age ratio was 8.3 juveniles to one adult, showing good production. This increase was probably the start of the Dansville pheasant comeback, along with the rest of the state, from the low years of 1945, 1946 and 1947. A summary of age ratio data is as follows in Table 20.

TABLE 20

HUNTING SEASON AGE RATIOS

Age	1950	1949	1948
Juveniles	No data	66	15
Adults	Ingham County 1:12	9	12
Unknown Age		6	11
Adult:Juveniles		1:8.3	1:1.25

Data from the post-season interview of farmers living adjacent to the game area show that 65 unbanded pheasants and 10 banded pheasants were taken on or adjacent to the study area. These pheasants were taken by the resident families or their relatives and friends and had not been previously reported. These data were not included in the yearly hunting comparisons as such information as actual number of hunters, hours hunted, game observed and other routine information could not be remembered by individuals so long after the hunts were completed.

State-wide hunting season records and data from other sample areas, such as Rose Lake Wildlife Experiment Station, show that the majority of the pheasants are taken on the first few days of the hunting season. After the first day even such excellent pheasant covers as Pelee Island reach a point of diminishing returns when considerable time must be spent in hunting to bag a pheasant. In 1949, 60 percent of all pheasants were taken the first week end, 23 percent the second week end. In 1950 approximately 70 percent of the entire season kill was taken the first week end. In all cases banded game-farm pheasants were taken at a faster rate than wild birds, indicating that the former are more vulnerable to hunting. Kill distribution and relative vulnerability to hunting pressure of wild pheasants and game-farm pheasants are summarized in Table 21.

TABLE 21

COMPARISON OF KILL DISTRIBUTION AND VULNERABILITY BETWEEN WILD AND BANDED PHEASANTS 1949 AND 1950 HUNTING SEASONS

Year	Banded or Wild	1st Week End	Percent of Total*	2nd Week End	Percent of Total*	3rd Week End	Percent of Total*	4th Week End	Percent of Total*
1949	Wild	49	59.8	25	30.6	8	9.6	Closed Season	
	Banded	40	62.5	22	34.4	2	3.1		
1950	Wild	35	53.8	17	26.2	4	6.2	9	13.85
	Banded	61	85.9	8	11.3	0	0	2	2.8

*Season total

Loss of Crippled Pheasants

Crippling loss has not been considered in the hunting season data. Accurate information regarding this loss was not collected at Dansville during 1949 and 1950. Detailed hunter report cards at the Rose Lake Wildlife Experiment Station show an average crippling loss of 22 percent over a period of 11 years. Rose Lake terrain and pheasant population are more nearly similar to that of Dansville than any other sample area where data are available. It is believed that the loss of crippled pheasants is a function of the particular game bird involved and human capabilities and therefore relatively uniform from area to area and year to year. It will be mentioned here that any complete kill calculation should involve an allowance for the loss of crippled pheasants. Such an allowance was not made in final analysis of the pheasant bags for 1949 and 1950 at Dansville.

It has been estimated that approximately 80 percent of the hunters were contacted during 1949 and 1950. In a final population analysis the data should be expanded from 80 to 100 in order for figures to represent the true pheasant situation.

Comparison with Hunting Data from Other Areas

A comparison of the 1949 and 1950 pheasant season data from Dansville with similar data from the Prairie Farm, Rose Lake, and the pheasant range as a whole, show the following: Hunter success was about the same at Rose Lake in 1950 and in 1949, but considerably better at the Prairie Farm in 1950 than in 1949. In 1950 success was poorer at Dansville and for the Michigan pheasant range as a whole. The yearly trend compared in these areas might be confused by the extremely high gun pressure at Rose Lake, by a change in cropping procedure at the Prairie Farm or from some unknown factor.

Rose Lake and the Dansville area are similar in that their hunter success is consistently poorer than that of the Prairie Farm or the pheasant range as a whole. This, of course, is to be expected because both areas have a high percentage of poor land and are sub-marginal pheasant range. Comparative data are presented in Table 22.

TABLE 22

PHEASANT SEASON DATA, DANSVILLE
PRAIRIE FARM AND ROSE LAKE

Area	Year	No. Hunters	Hours Hunted	Pheasants Taken Banded	Wild	All	Hunter Success: Hours Per Bird*	Pheasants Per 100 Hours*	Bird Per Hunter*
Rose Lake	1949	1948	5079	?	?	73	69.5	1.4	.04
	1950	1802	4716	2	74	76	64.0	1.1	.04
Prairie Farm	1949	853	2985	-	155	155	19.3	5.2	.18
	1950	635	2306	-	216	216	10.7	9.4	.34
Dansville	1949	708	2305	64	82	146	28.0	3.5	.12
	1950	1171	3879	71	65	136	59.0	1.7	.055
Southern Michigan	1949	3584	10,657	-	937	937	10.8	9.3	.27
	1950	2907	9847	-	728	728	13.5	7.4	.25

*Wild only

PHEASANT POPULATION STUDY
WINTER 1949-1950 AND
WINTER 1950-1951

Census

During two winters the Dansville area was systematically cruised on foot to obtain as much information as possible about the pheasant population. Attempts were made to do field work after fresh snow in order to track pheasants.

During the winter of 1949 and 1950 observations of 329 hens and 154 cocks were made. An estimate of the winter population, based on location of observations and size of observations, was 81 cocks and 167 hens. In the winter of 1950 and 1951, 378 hens and 184 cocks were seen. It was estimated that the winter population was approximately 90 cocks and 202 hens; 9 cocks and 35 hens more than the previous year.

Track observations indicated that the pheasants were distributed over all the area but fewer were nearer the center. Winter population data are summarized in Table 23.

TABLE 23

ESTIMATED WINTER PHEASANT POPULATIONS

Year	Cocks	Hens	Sex ratio	Cocks per 100 acres	Hens per 100 acres	Cocks & Hens per 100 acres
1949-1950	81	167	48M:100F	1.8	3.7	5.5
1950-1951	90	202	44M:100F	2.0	4.5	6.5

Predators and Mortality

Fox-den sites were examined from time to time during both winters but no evidence of use was found. However, most of the dens were excavated in the fall of 1949. Fourteen sets of fox tracks were followed during the two winters. The foxes caught mice and a rabbit but did not bother any game birds. One hen pheasant was found dead near trap No. 6. Two hens were killed by dogs near trap site #3.

Live Trapping

During the summer of 1949 four standard small game traps were procured from The Rose Lake Wildlife Experiment Station and four lily-type pheasant traps were constructed. The traps were baited with half ears of dried corn as well as shelled kernel corn. Tins of water with small perforations in the bottom were placed on top of the traps so that the water dripped slowly into a small container below. In all cases, pheasants had been seen more than once in the immediate area where the traps were set. Traps were set during the period May 7-26, for 12 days or a total of 96 trap days. No pheasants were caught.

Trapping Record: Number of traps - 8; Bait - corn and dripping water.

Trapping Stations

#1 - Dexter Trail. Set 5-6-49. (Brush at edge of Marsh)
Location: 28-14-2-SW. Catch - 0

#2 - Dexter Trail. Set 5-6-49. (Brush in Marsh)
Location: 28-14-1-SW. Catch - 0

#3 - Seven Gables Road. Set 5-7-49. (Briers at edge of Marsh)
Location: 33-8-1-SE. Catch - 0

#4 - Seven Gables Road. Set 5-7-49. (Briers at edge of Marsh)
Location: 33-7-4-NW. Catch - 0

#1 - Potter Road. Lily trap. Set 5-7-49
Location: 32-2-4-SW. Catch - 0

#2 - Meridian Road. Lily trap. Set 5-7-49
Location: 29-5-4-SE. Catch - 0

#3 - Dexter Trail. Lily trap. Set 5-7-49
Location: 28-11-2-NE. Catch - 0

#4 - Seven Gables Road. Lily trap. Set 5-7-49
Location: 33-7-2-SW. Catch - 0

More successful winter trapping was carried on from January 5, 1950 to March 4, 1950, a total of 38 days. The traps were constructed after plans of the Standard "Ohio" or double "Lily" type trap. In all trapping operations corn was used as bait. The traps were left open and baited for three weeks prior to the start of actual trapping. Traps were left open two days after each five-day trapping period to allow pheasants to become familiar with sites. Four traps were open for 15 days and 7 traps for 23 days for a total of 161 trap days.

Eleven pheasants were trapped, tail-clipped and banded with regular metal bands and with two white bands. A twelfth bird was caught but escaped through an opening at the edge of the trap entrance. Three birds were caught twice. Of two hens killed by dogs, one was found inside and one outside of trap #3. Dogs visited all traps at least six times and two traps were visited at least every day that there was snow to leave tracks. The lack of snow and the thin distribution of the pheasants during the early part of the trapping period might be considered reasons for the poor catch. The bait was constantly eaten by rabbits, squirrels

and songbirds. Pheasant tracks were seen at all trap sites each day after February 23. The reason for failure to catch more pheasants when fairly large flocks were known to frequent the trap sites, especially in the case of sites 1, 2, 6 and 7, has not been determined. A quail was found dead (almost completely eaten) in trap #1. It was thought that at least 30 birds should be trapped in order to have a high enough proportion of marked birds to use a Lincoln index from observation in the following spring. Trap locations are shown in Figures X and XI.

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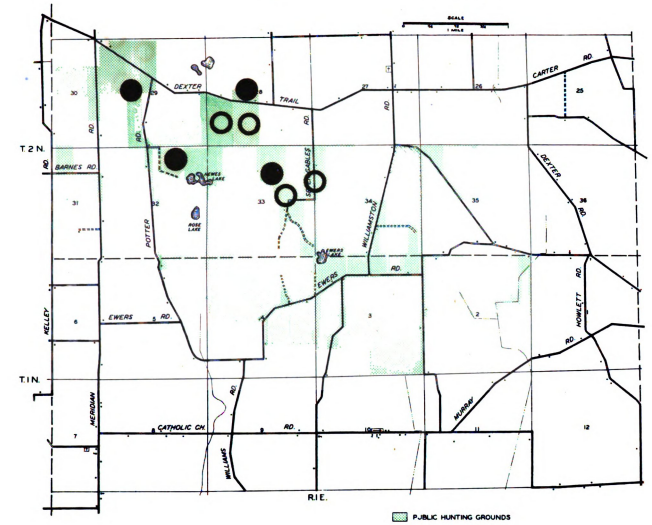
INGHAM COUNTY

Figure X

Trap Locations Summer 1949



BASE LEGEND

- HARD SURFACED ROAD
- GRAVEL ROAD
- GOOD DIRT ROAD
- POOR DIRT ROAD
- OCCUPIED HOUSE
- VACANT HOUSE
- SCHOOL HOUSE
- CHURCH
- CEMETERY

● Lily Type Trap

○ Standard Box Trap

GA-52

Corrected by LBT 53

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DANSVILLE STATE GAME AREA

INGHAM COUNTY

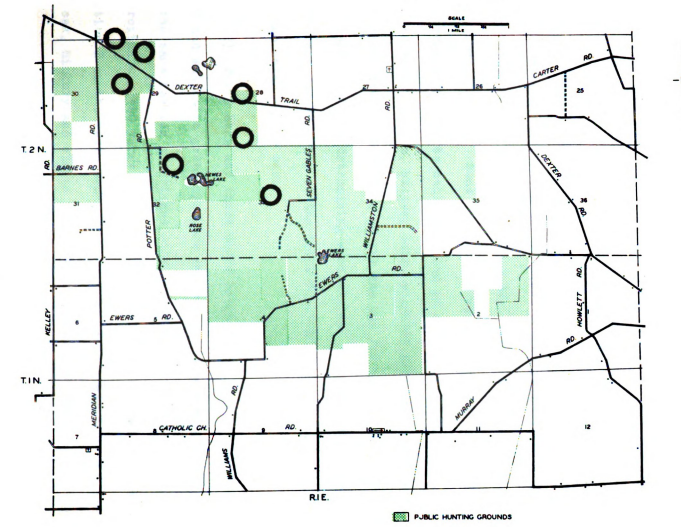

Figure XI

Trap Locations
Winter, 1949-1950

BASE LEGEND

- HARD SURFACED ROAD
- GRAVEL ROAD
- GOOD DIRT ROAD
- POOR DIRT ROAD
- OCCUPIED HOUSE
- VACANT HOUSE
- SCHOOL HOUSE
- CHURCH
- CEMETERY

Lily Trap Location

GA-52

Corrected by CBH 3-47

53

STUDY OF RELEASED PHEASANTS

Method of Release

On April 2, 1949, 164 pheasants (150 hens and 14 males, two of which were a mutant white strain) were released in the Dansville State Game Area. The pheasants were loaded in crates and transported to the release areas by truck. Releases were as follows:

(1) Forty hens and four cocks, one of which was a white mutant, were released at 11:00 A.M. on the Seven Gables Road designated as release point #1 (Map reference 34-5-2-SW). All pheasants were banded with aluminum bands. Hens were banded with one yellow celluloid band and cocks with a white celluloid band on each leg. Cocks and hens were painted on the throat, breast, back, scapular and secondary feathers with eosin dye. The purpose of the dye was for identifying birds in the field and to aid in determining mortalities. The pheasants were hand-released. The majority of the birds flew into a corn stubble field or a sedge marsh to the east.

(2) Forty hens and three cocks marked with blue numbered celluloid band and malachite green dye were released at approximately 12:30 P.M. in the same fashion at release site designated as #2. The site is approximately 400 yards east of the north and south road, bordering section 2 on the west (Map reference 2-5-1-SE). Idle land and lowland of oak, hickory and elm to the east and north received most of the birds.

(3) Forty hens and 3 cocks, one cock a white mutant, were released at approximately 1:30 P.M. and marked with numbered red and yellow celluloid bands. Cocks were marked with two white bands. This area was on Dexter Trail and was designated as #3. The birds were painted with eosin dye and released approximately 200 yards south of Dexter Trail (Map reference 28-14-1-NW). Wooded swamp, idle land and general cropland dominate this site.

(4) Thirty hens and four cocks were released on Potter Road in section 5 (Map reference 5-2-1-NE). These pheasants were painted with malachite green dye, and banded with plain white celluloid bands. The cocks were banded with white celluloid bands on each leg. The release site was mainly idle land, sedge swamp and oak woods.

The method of determining the fate of the released birds was to observe their actions with glasses and to follow them till they roosted for the first night. After the day of release a concentrated search, first of the immediate area, then of the adjacent areas, was made. The hunt was conducted by systematically gridding the area at intervals of approximately 10 feet.

From April 3 to June 4, 1949, approximately 70 man hours were spent in gridding areas surrounding the release sites. Approximately 375 man hours were spent in cruising the four release areas and areas adjacent to them. Observations of mortalities, birds flushed, predators and any item of significance were noted during the gridding and cruising. All mortalities that were found were marked by a three-foot stake painted a light grey.

Fate of Released Pheasants

Twelve percent of the pheasants were recovered as mortalities during the first seven weeks (see Table 3 in appendix). Considering the extremely heavy vegetative cover on the Dansville area it is quite reasonable to presume that many additional pheasants died shortly after release. Released pheasants were not observed after seven weeks, though wild cocks were. None of the crowing cocks identified were from this group of marked pheasants. Wild cocks were repeatedly observed and on territories established in the immediate area of the release points. No change in territories was noted and although the same wild cocks were observed throughout the spring, released pheasants vanished.

Pheasants were found as mortalities as close a few yards to as far away as a mile from the point where they were released. The average distance from the release point to where they were found dead was approximately 500 yards.

The pheasants tended to band together for the two days, thereafter they gradually separated. The released pheasants in many cases appeared dazed and did not flush as readily as wild pheasants.

On August 31, 1949, 200 game-farm cock pheasants were released on the area; 100 were hatched from game-farm eggs and in addition to regular metal leg bands were marked with numbered yellow bands, 100 were hatched from wild pheasant eggs and had affixed unnumbered red bands. Ten each of the above described birds were released at 10 release sites (see Table 4 in appendix). The release was part of a larger similar release made by

the Game Division for the purpose of determining relative hardiness and resistance to hunting pressure of pheasants from game-farm strains and from the wild strains.

Twenty-two cocks hatched from wild eggs were shot or found dead and 18 cocks from game-farm eggs were bagged (see Table 5 in appendix). The difference between the "hunting take" of the two strains is insignificant. Due to the lack of data the distance from release point to where the birds were taken is not known.

The Michigan Department of Conservation released 200 cock pheasants on the Dansville area August 31, 1949 and 200 more September 8, 1950. The 1949 release was 45 days before the hunting season, the 1950 planting was 33 days before hunting season. The kill of banded birds in 1949 was 64, and 71 in 1950. It is possible that predators, during the longer period before hunting season, took a heavier toll of released pheasants in 1949 or that due to increased hunting pressure in 1950 more marked birds were bagged.

PREDATOR STUDY, 1949-1950

Spring and Summer 1949

Observations of dens and predators were made while searching the area for released pheasants. Additional observations were made while traversing portions of the study area for the express purpose of obtaining such data. Approximately 50 man hours were spent in this manner.

Dens. All dens discovered on the area were closely examined for odor, tracks and other signs of occupancy. Three showed signs of use. Fox tracks and odor were observed at one of these dens (location: 33-4-2-NE). The carcass of a hen pheasant, band #116909, was found about 75 feet SW from this den, in the marsh grass. One red fox pup was observed on April 9 near the opening of another den (location: 34-12-2-SE).

A cluster of pheasant feathers was found in the grass at the edge of a field, (34-4-1-SE), approximately 25 feet north of a den under the root system of a large windfall. A trail of feathers led to the den and bones and feathers were found in the opening. Eosin dye on the feathers identified the kill as a released bird. No bands were found.

Nests. Approximately 30 man hours were spent cruising the woods looking for hawk and owl nests, but none was found. Bands of released birds had been found in several red-tailed hawk nests and on the ground underneath them, but none of these nests were occupied in 1949.

Mammal Predators

Red Fox (Vulpes fulva). An adult red fox was observed on April 3 about 300 yards SW of release point #1 on Seven Gables Road, at approximately 7:00 P.M.

As mentioned above, one fox pup was discovered at the opening of a den (34-12-2-SE) on April 9 by several part-time student employees while gridding this section of woods. The pup was banded and released at the same spot. Later, on April 16, a fox trail was found winding through upland and lowland woods in the same vicinity. A light snow had fallen the previous night, facilitating tracking in the woods; however, rapid melting in the fields prevented further tracking.

The red fox is a well known predator of pheasants and it is quite likely that the foxes ranging throughout these areas have accounted for some of the mortalities which have been discovered and some which have not. In many cases only the tell-tale dyed feathers were found, indicating that the carcass was devoured on the spot or carried off by a bird or mammal.

The red fox, though chiefly nocturnal, often ventures out during the day, especially in the late morning and in the early evening. Although primarily carnivorous, feeding chiefly on small mammals, the fox also takes berries and fruit in season.

According to Pearce (1945), foxes take their greatest toll of male birds in the spring, while later, when nesting is underway, they catch more hens. He believes the crowing behavior of the cocks attracts the fox.

Raccoon (Procyon lotor). Tracks of this species were observed along the west side of Seven Gables Road (33-1-1-E ½, 33-1-9-E ½, 33-8-1-E ½ and 33-8-4-E ½) and in sandy areas nearby on April 16. Another raccoon trail was found along the fence row (28-10-2-W ½, 28-10-3-W ½, 28-15-2-W ½ and 28-15-3-W ½) east of release point #3 on Dexter Trail on the 26th of April. On May 6 raccoon tracks were seen in the muck at the edge of the marsh (33-15-5-NE) near the end of Seven Gables Road.

Leedy and Hicks (1945) recognize the raccoon as a predator of the pheasant in Ohio, but believe that such predation is relatively unimportant. Pearce (1945) found the same to be true in New York and New England.

House Cat (Felis domesticus) and Dog (Canis familiaris). Three cats were seen on the study area at various times. All appeared to be hunting. Two dogs were observed in a field (28-10-2) on May 14.

In Ohio, Leedy and Hicks (1945) found that cats and dogs were responsible for more pheasant losses than were natural predators. Young pheasants and incubating hens appear to be especially vulnerable to these animals.

Weasel (Mustela frenata). Mortality #5 (Table 3 in appendix, page 135) contained a ½ inch slit underneath the left wing, indicating a possible weasel kill.

Birds of Prey

Hawks and Owls. A red-tailed hawk (Buteo jamaicensis) was seen in a tree bordering Williamston Road (34-10-3-NE) on April 17. It flew when approached, heading towards the nearby woods. It was harassed by two crows. Another observation was made of a red-tailed hawk on May 20 in a tree a short distance from release point #1 (38-8-4-NW). Several crows kept diving at it and finally it flew, with one of the crows in pursuit.

A red-shouldered hawk (Buteo lineatus) was seen perched in a tree at the edge of Potter Road (29-14-1-NE) on April 30. When approached it took off and was harassed by a crow as it flew over the woods.

Two hawks, believed to be either red-tailed or red-shouldered, were observed flying high over release point #1 (34-4) on May 7. One was being chased by two crows. Another pair, unidentified, flew very high over Ewers Lake (3-4-2) on May 13.

Marsh hawks (Circus cyaneus) were observed consistently throughout the study. They were seen at many points in the study area. Pairs were seen very often at the following locations (5-1-1, 28-12-1, and 33-7-1) and it is quite possible they nested in these areas.

Inspection of red-tailed hawks' nests after previous releases of game-farm-reared pheasants, has revealed remains of carcasses and bands of the birds (Black[1] - verbal testimony). The evidence seems to indicate that this particular species will take a pheasant when the opportunity

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[1]Black, C. T. - Game Biologist, Rose Lake Wildlife Experiment Station

arises. The red-shouldered hawk is not apt to take an adult bird, but may capture a young one. Marsh hawks normally have not been known to take adult birds, but do prey on the young.

The great horned owl (Bubo virginianus), Cooper's hawk (Accipiter cooperii), and goshawk (Accipiter gentilis) are known predators of pheasants. None of these species were observed in the study area. However, in 1949 two students from Michigan State College advised that they had observed a horned owl just before dusk in the area. Horned owls were often heard during early mornings.

Crows (Corvus brachyrhynchos) were observed consistently throughout the area. The crow is known to be destructive to pheasants during the nesting season, when eggs and young are taken.

Fall and Winter, 1949-1950

On September 15 a survey of known animal dens was made in the Game Area to determine which were active and deserving of further investigation. Most of the dens appeared old and unused. Six dens were selected for further investigation.

Only one den showed evidence of pheasant predation which was as follows: Den #3 was located on a south slope, (S ½, NW ¼, SE ¼, Section 33). The den was 16 feet in length and approximately 8 inches in diameter. It was tunneled through soft sandy loam. Pheasant feathers were observed at the mouth of the den. Upon excavation complete skeletal remains of a cock pheasant released two weeks previously were found. The leg bands, both celluloid and metal, were intact. The rest of the carcass had been

consumed; only feathers, bones and bands remained. No conclusive evidence as to the species of animal that had entered the den with the pheasant was found.

Interview with Local Trapper. On September 28, 1949, Mr. Cordie Barker, a resident near the Dansville State Game Area who has trapped and hunted fox intensively, was interviewed. He stated that in April, 1948 he and a companion attempted to dig out a fox den located on a south slope (SE ¼, SE ¼, NW ¼, Section 32 T 2N, R1E) approximately one-eighth of a mile southwest of Hewes Lake. The den was known to contain fox pups. Due to soft sand and the caving in of the tunnel the excavating was discontinued, but subsequently Mr. Barker trapped six young foxes near the den. In April, 1948, 14 fox pups were trapped by Mr. Barker at a den by a drainage ditch, (location: N ½, SE ¼, NE ¼, Section 2, T 2N, R1E). Eight fox pups were trapped at the above den site in the spring of 1947. Ten fox pups and two adults, male and female, were trapped at a den site (located in the SW ¼, NW ¼, SW ¼, Section 35, T 2N, R1E) in the spring of 1948. Two adult foxes were shot by Mr. Barker in the SE ¼ of Section 33, T 2N, R1E during the winter of 1947-48. Mr. Barker definitely recalled that eight adult foxes have been shot, running ahead of dogs, by other hunters. It is probable that most of these foxes were not residents of the game area, but were only foraging there or chased in by dogs.

A total of 32 fox pups was trapped by Mr. Barker in the game area during 1947, 1948 and 1949. Four adult foxes were trapped during the same period of time. Ten adult foxes were shot in the area from 1946

to 1949, and from 8 to 10 adults were observed but not taken during 1948 and 1949. Animal carcasses or other remains observed in den mouths or near dens were two freshly killed weasels at one den mouth, raccoon carcasses at two different dens (probably highway kills) and four newly killed cock pheasants at another den. Other remains at various dens included skunks, meadow mice, domestic chickens, pheasants, rabbits, squirrels and unidentified parts of small birds and mammals.

EVALUATION OF THE DANSVILLE AREA AS PHEASANT HABITAT

Food and Cover

Food-habits studies of pheasants in the lake states area show that the primary vegetable foods are: Zea Mays (cultivated corn), Ambrosia elatior (ragweed), Symplocarpus foetidus (skunk cabbage), Vitis sp. (wild grape), Avena sativa (cultivated oats), Quercus sp. (oak), Sambucus sp. (elderberry), Fagopyrum sagittatum (cultivated buckwheat), Prunus sp. (wild cherry), Triticum aestivum (wheat), Solanum sp. (nightshade), Setaria sp. (fox-tail), Rhus sp. (Sumac), Arctium sp. (burdock), Glycine Max (soybean) and Cornus sp. (dogwood). Twenty-five to fifty percent of pheasant diets was made up of corn (Martin, Zim, and Nelson, 1951).

The Dansville area has a good supply of all of the above listed foods except corn, ragweed, oats, buckwheat, soybeans and wheat. The shortage is in farm crops, especially grains. A share-cropping and food-patch program was and is being carried out on the study area. This type of program is limited by funds and the topography of the area. Some of the cleared land is not level enough for herbaceous development without danger of erosion. A large portion of the area is a centrally located lowland woods and marsh which offers excellent year around cover for pheasants, but very little winter food. The perimeter of the area is fringed by private farms. The spatial cover distribution is one of excellent cover and little farm crop food in the center with more farm crop food and reduced cover around the outer edge.

The Dansville area has only half as much acreage in farm crops as adjacent lands, only one-sixth as much as typical farmland within three miles of the area, and one-tenth as much as the Prairie Farm. The cover analysis of the Dansville area is summarized in Table 24.

TABLE 24

PERCENTAGE COMPOSITION OF COVER TYPES OF THREE AREAS

Area	Grassland	Cropland	Woodland	Swampland	Total
Dansville Area	40	8.5	27.2	24.3	100
Adjacent Land	60.2	17.0	7.9	14.9	100
Prairie Farm†	10.0	80.0	10.0	----	100
Typical Farm Area*	37.6	50.0	9.3	3.1	100

*Analysis of 1000 acres within three miles of the Dansville area
†Blouch, R. I. and Eberhardt, L. L. Paper presented at 15th Midwest Wildlife Conference 1953.
Grassland and Woodland percentages are approximate

The 154 common higher plants collected on the Dansville area (see appendix Table 6) have been checked for food value to pheasants by Martin, Zim, and Nelson (1951). It was found that 54 percent of the shrubs and 31 percent of the herbs were used in varying amounts as food by pheasants in the "Lake States" area. Use for food by pheasants of plants collected on the Dansville area are as follows in Table 25.

TABLE 25

PERCENT OF TOTAL PLANTS COLLECTED AT DANSVILLE FOUND IN PHEASANT DIETS IN NORTHEAST UNITED STATES

	Percent of Diet					
	0 - ½%*	½ - 2%	2 - 5%	5 - 10%	10 - 25%	No. Plants
Shrubs	45.7	34.3	8.6	2.8	8.6	35
Herbs	69	22.5	6	2.5	0	119

*Most of these were not represented in the diet (Martin, Zim and Nelson, 1951)

DISCUSSION OF THE DANSVILLE PHEASANT POPULATION 1949-1950

From the crowing cock study, the spring population of male pheasants was determined to be 42 in 1949 and 70 in 1950, an increase of 66 percent. The spring sex ratio was 64M:100F in 1949 and 43M:100F in 1950. It was not known for either summer what percent of the total broods had been located, but considering complete searching efforts each year it is estimated that at least 80 percent of the broods were located. If the brood number for each year is expanded from 80 to 100 percent, then in both 1949 and 1950 there were approximately 40 broods reared on the Dansville area. In 1949 the average size of complete full-grown broods was 9.2 chicks. If 40 broods were reared, then 368 chicks was the 1949 pheasant production, half of which were cocks. When the chicks are added to the breeding population, (42 cocks and 66 hens based on a sex ratio of one cock to 1.56 hens) the total pre-season population of wild pheasants was 476 pheasants (226 cocks and 250 hens). In addition 200 game-farm cocks were released, making the total number 676 pheasants. The 1949 pre-hunting season pheasant population is summarized in Table 26.

TABLE 26

ESTIMATED PHEASANT POPULATION BASED ON POPULATION STUDIES
FALL - 1949

	No. Pheasants	Birds per acre	Acres per bird
Cocks (wild)	226	.05	19.9
Cocks (released)	200	.04	22.5
Hens	250	.05	18.0
Total (wild)	476	.10	9.4
All Pheasants	676	.15	6.6

In 1950 the average size of complete full-grown broods was 10.2 chicks; however, this number is believed to be higher than the true situation because the average size of all broods seen in 1950 was lower than in 1949. Brood sizes were reported larger as the summer progressed instead of smaller; this might have been due to the merging of broods (see Tables 11 and 12). As the average size of three-quarter grown complete broods was about the same for both years, the average size of complete full-grown broods in 1949 was used both years in computing pheasant production. The 1950 chick production would be 40 broods times 9.2 or 368 chicks, one half of which would be cocks. The breeding population (70 cocks and 162 hens) added to the number of chicks give a 1950 pre-season population of 600 pheasants. In addition 200 game-farm pheasants were released, making a total pre-hunting season population of 800 pheasants. The 1950 pre-season pheasant population is summarized in Table 27.

TABLE 27

ESTIMATED PHEASANT POPULATION BASED ON POPULATION STUDIES
FALL - 1950

	No. Pheasants	Birds per acre	Acres per bird
Cocks (wild)	254	.056	17.7
Cocks (released)	200	.04	22.5
Hens	346	.077	13.0
Total (wild)	600	.133	7.5
All Pheasants	800	.177	5.6

It was estimated that at least 80 percent of the hunters were interviewed during the two years. Expanding the kill from 80 to 100 percent would yield a bag of 103 wild cocks and 80 game-farm cocks in 1949, whereas 81 wild cocks and 89 banded cocks were taken in 1950. Farmers and their friends living next to the area took 65 wild pheasants and 10 game-farm pheasants, either on the Dansville area or immediately adjacent to it. This addition give an estimated pheasant bag in 1949 of 168 wild and 90 banded cocks. Farmers were not interviewed in 1950. However, it is believed that their bag would be about the same percent of total that it was in 1949, that is, 63 percent of the wild bag and 12 percent of the game-farm pheasant kill. Adding these percentages to the 1950 bag gives a 1950 total kill of 132 wild and 100 game-farm cocks.

The estimated pheasant bag per 100 acres was 5.7 in 1949 and 5.1 in 1950. A summary of the estimated total pheasant kill during the two years is given in Table 28.

TABLE 28

ESTIMATED TOTAL PHEASANT BAG AND KILL
PER 100 ACRES - 1949 AND 1950

	Total kill	Game-farm pheasants	Wild pheasants	All pheasants
1949	258	2.0	3.7	5.7
1950	232	2.2	2.9	5.1

A method of pheasant inventory based on kill records and sex ratios (Allen 1942) was used to compare data with inventory estimates based on the population studies. The expanded kill figures used in the calculations were estimates. The calculations are presented in Table 29.

TABLE 29

CALCULATION OF PHEASANT NUMBERS AT DANSVILLE
BASED ON SEX RATIO AND HUNTING BAG

	1949	1950
Pheasants flushed opening day	148M: 75F	323M: 181F
Sex ratio	197M: 100F	178M: 100F
Cocks killed per 100 acres	5.7	5.1
Pheasants flushed last three days of the hunting season	26M: 59F	36M: 50F
Sex ratio	44M: 100F	72M: 100F
Percent cocks surviving	$\frac{44 \times 100}{197} = 22$	$\frac{72 \times 100}{178} = 40$
Percent cocks killed	100-22 = 78	100-40 = 60
Pre-season population per 100 acres		
Cocks	$\frac{5.7 \times 100}{78} = 7.2$	$\frac{5.1 \times 100}{60} = 8.5$
Hens	$\frac{7.2 \times 100}{81} = 8.8$	$\frac{8.5 \times 100}{178} = 4.7$
Total	15.0	13.2
Post-season population per 100 acres		
Cocks	7.2-5.7 = 1.5	8.5-5.1 = 3.4
Hens*	8.8	4.7
Total*	10.3	8.1
Pre-season cock population per 100 acres minus 150* released game-farm cocks	7.2x45-150 = 174	8.5x45-150 = 232
	174÷45 = 4.0	232÷45 = 5.1

*Does not include the kill of hens during the hunting season. This method does not include crippling loss.

Calculations based on differences in sex ratio of pheasants flushed at the start and at the end of the season show 18 percent more of total cocks surviving the hunting season in 1950. This is possible as more birds were seen per hour during 1950 and more time was spent hunting, whereas fewer were shot (see Table 19). Differences in population numbers as estimated, and as calculated from sex ratio difference during the hunting season, are as follows (Table 30):

TABLE 30

DIFFERENCES BETWEEN ESTIMATED AND CALCULATED DANSVILLE PHEASANT NUMBERS, 1949 AND 1950

	1949		1950	
	Calculated	Estimated	Calculated	Estimated
Pre-season populations per 100 acres				
Cocks	7.2	9.0	8.5	9.0
Hens	8.8	5.0	4.7	7.7
Total	15.0	15.0	13.2	17.7
Wild cocks	4.0	5.0	5.1	5.6
Post-season population				
Cocks	1.5	3.3	3.4	4.4
Hens	8.8	5.0	4.7	7.7
Total	10.3	8.3	8.1	12.1

Because of the very light hunting on the Dansville area during the last few days of the season during both years, it is quite possible that false pictures of the sex ratios were obtained each year. In addition, the kill should be known and not estimated.

The winter census (Table 23), although possibly too low, was more in agreement with the 1949 calculated post-season cock population and with the estimated hen number. In 1950 the winter census was more in agreement with the calculated population. Of course both calculated and estimated population figures would tend to be higher than a winter census because of the crippling loss in cocks and the regular non-hunting mortality of both sexes that reduces the population each day.

FINDINGS

Crowing Cock Study

In all weather conditions and times before and after sunrise where sufficient data were available, the percent increase in crowing frequencies of 1950 over 1949 was substantial enough to be considered significant and in keeping with the 66 percent increase in the cock population. The higher counts at Dansville were in accord with a 39 percent increase in crowing index throughout Michigan pheasant range.

Crowing frequencies were significantly higher at temperatures above 39°. Higher crowing frequencies were recorded when the wind velocity was below 16 miles per hour. Preliminary experiment with crowing counts showed that little or no crowing was done during inclement weather.

Summer Brood Studies

In view of a 66 percent increase in the breeding cock population and a 41 percent increase in hens, it might have been expected that a similar increase in brood production would have taken place. This, however, was not the case as the same number of broods was located each year. Pheasant broods were for the most part larger in 1949 than in 1950. There were 1.9 more pheasant chicks observed per brood in 1949 than in 1950. In 1949 the size of complete broods tended to get smaller as the season progressed. The opposite was true in 1950 when the size of complete broods grew larger. One more chick per complete full-grown brood was observed in 1950 than in 1949.

In 1949 data from the Dansville area show a peak in hatching during the first two weeks in June (Fig. VII). Age data from field observation of broods and from wing-molt age determination are in approximate agreement as to hatching distribution up to July. The hatching distribution, as determined by fall wing-molt, shows another small peak occurring during the first week in July, a week earlier than when a second peak occurs as shown by brood data.

During 1949 brood data from the Prairie Farm show a peak in hatching about two weeks later than at Dansville; however, data from wing-molt determined ages coincide with the June 4 - 10 hatching peak at Dansville and also agree with the second small peak in hatching July 9 - 15 (see Fig. VIII).

In 1950 three hatching date peaks, June 4 - 10, 18 - 24 and July 2 - 8, were obtained from brood age data. The second and third hatching peaks coincide with the June 18 - 24 and July 2 - 8 peaks on the Prairie Farm.

Hunting Seasons - 1949 and 1950

A longer hunting season, more hunters and increased hunting effort harvested 20 percent fewer pheasants in 1950 than in 1949. Approximately the same number of pheasants were observed for each 100 hours of hunting time for both years; however, only one-third as many were seen per 100 hours as were observed on average Michigan pheasant range.

The sex ratio was about the same in 1949 and 1950. During each hunting season approximately as many cocks were observed as hens. The

proportion of hens to cocks was low both years compared to all Michigan pheasant range which was 67 cocks to 100 hens.

The ratio of juvenile pheasants to adults increased greatly in 1949, and apparently increased a little in 1950.

In both 1949 and 1950 most of the pheasants were taken during the first week of the season. Released game-farm birds were taken earlier in the season than were wild pheasants.

The Dansville area hunting season data followed the state-wide trend of poorer hunting success in 1950 than in 1949. At Rose Lake hunting success remained the same for both years whereas at the Prairie Farm hunting success was higher in 1950.

Many hunters expressed the opinion that hunting conditions were more difficult in 1950 than they were the previous year.

Winter Population Studies

Winter census efforts of the same magnitude showed an increase of .2 cocks and .8 hens per hundred acres in 1950-1951.

An attempt to live-trap pheasants during the summer of 1949 and winter 1949-1950 failed. The winter trapping entailed the expenditure of many days work with only 12 pheasants taken.

Predator investigations carried out incidental to census work showed the dog to be the only apparent offender. Other evidence of predation was not found.

Study of Released Pheasants

Twelve percent of the 1949 spring release were recovered as mortalities during the first seven weeks. There were 12 suspected mortalities where remains offered no proof that the pheasant was one of those released. Marked game-farm pheasants were not observed after seven weeks though wild birds were observed each day. However, four hens of the group released were observed with broods during the following spring. Another leg-banded hen was observed with a brood, but she was from a previous release of game-farm pheasants. None of the cocks were taken during the following hunting season.

Mortalities of released pheasants were found at distances of only a few yards from the release site to one mile away. For the first few days the game-farm birds appeared dazed and not alert enough to escape predators. There was no significant difference in the number of game-farm and wild-strain pheasants shot in 1949.

Predator Study

It is presumed that the Dansville area has representatives of all predator species common to southern Michigan. Remains of pheasants were found around four dens known to have been used by foxes. During the summer brood study a marsh hawk was observed eating a freshly killed pheasant chick. Stray dogs were known to have killed three pheasants near trapping sites.

An interview with Mr. Cordie Barker, a resident near the Dansville area, revealed that foxes were common to the area and that approximately 50 foxes had been taken during the period of 1947 to 1949.

Evaluation of Dansville Habitat

The Dansville area has a good supply of fruits of woody plants and herbs that make up the diet of pheasants in the "Great Lakes states" area, but is lacking in cultivated grains, other farm crops, and fields of good herbaceous cover for nesting. A large central portion has adequate cover and food but poor interspersion of these necessities. The Dansville area has only half as many farm crops as adjacent lands, only one-sixth as much as farmlands nearby and one-tenth as much as recognized good pheasant range such as the Prairie Farm. There are few suitable sites for the establishment of supplemental patches of food and herbaceous cover in the central part of the Dansville area.

Discussion of the Pheasant Population

Estimated pre-hunting season pheasant population figures were compared with numbers obtained from a calculated inventory method using the difference between the sex ratio of pheasants flushed at the start of the season and those flushed at the end of the season plus the known kill (Allen 1942). The pre and post-hunting season population, as calculated from the change in sex ratio and the kill, was higher in 1949 than in 1950. The population as estimated was higher in 1950 (see Table 30). Calculations indicate that 18 percent more cocks survived the 1950 hunting season than in 1949.

CONCLUSIONS AND RECOMMENDATIONS

Crowing Cock Study

An accurate spring census of cock pheasants can be made on areas similar in size and topography to the Dansville area using the intersection of crowing directions to locate birds in their crowing territories. This method involves less time and effort than the actual "following up" of crowing pheasants. In this study crowing cocks were "followed up" to verify locations established by crowing directions.

The findings were that pheasants were heard crowing more when temperatures were above 39° and when the wind was below 16 miles per hour. Therefore when a spring cock pheasant census, utilizing intersection of crowing directions is to be made on an area, it is quite important that the work be done during a time of optimum crowing conditions. If directions and counts are taken when a maximum of crowing is being done more complete sets of directions are available and crowing counts more nearly represent the entire population. Census work done under these near ideal conditions would, of course, require less time and effort to obtain an accurate cock population figure.

Summer Brood Studies

The reasons for the size of complete broods increasing as the summer progressed in 1950 are not clear. It might have been due to the merging of smaller broods causing abnormally large flocks for that late in the summer.

Hatching of pheasant chicks progressed about the same at Dansville as on other areas during 1949. In 1950 a gap in the hatching curve during June 11 - 17 indicated no hatching or a loss of broods hatched during that period. This is a possible partial explanation for the failure of the larger 1950 breeding population to produce more broods than were found in 1949. Smaller peaks during July 2 - 8 and July 30 - August 5 for both the Dansville area and the Prairie Farm probably represent renestings.

Dansville data for both 1949 and 1950 show no single peak in hatching data distribution as is characteristic for the Prairie Farm and other sample areas. This might be due to the fact that the Dansville area is relatively small and broods might tend to be "on and off" the area during the time when the study was being made. The surrounding farms might have enticed broods of the study area with their larger supply of food. The Prairie Farm and other places considered, are better pheasant habitat, larger in area, and brood data were gathered over a smaller period of time.

It has been shown that a higher breeding population does not necessarily mean more pheasants in terms of more broods or larger broods. Therefore managers of game areas should make every effort to establish routine brood study routes covering the entire area concerned. If information on brood number and size approaching 100 percent is obtained reasonably early in the summer, the biologist can accurately state the number of pheasants avilable for shooting in the fall.

Hunting Seasons - 1949 and 1950

The decrease in hunter success in 1950 was due to the increase in hunting pressure when only the same number of pheasants was available.

Pheasants observed per 100 hours of hunting were about the same each year indicating very similar fall populations. Only one-third as many pheasants were seen per 100 hours of hunting during both years as were observed on average Michigan pheasant range. This indicates a relatively low population at the Dansville area for both years. The ratio of hens was low both seasons as compared to the rest of Michigan pheasant range. A lower proportion of hens to cocks does not seem favorable to productivity when it is compared with that of all the pheasant range. The ratio of juvenile pheasants to adults increased greatly in 1949, and apparently again in 1950, indicating that, along with the rest of the state, the Dansville pheasants were on their way to population recovery.

Most of the pheasants were taken the first week of the season and released game-farm birds were more vulnerable to hunting than were wild pheasants. This suggests that possibly the season length might be extended on pheasants as a point where the shooting is poor is soon reached. Such a situation limits the number of hunters to but a small fraction of those hunting on opening day.

Pheasant Trapping

Pheasant trapping is not practical on areas with a relatively low pheasant population and good cover.

Study of Released Pheasants

Field studies indicate that the 1949 spring release of 14 cocks and 150 hens were for the most part lost during the summer. None of the cocks were found in the hunting harvest in the fall. However, four of the hens were observed with broods during the following spring and summer. In view of the fact that it is thought that most of the broods and hens were located the hen survival was approximately 3 percent.

The higher kill (71) of game-farm pheasants in 1950 over that (64) of 1949 might have been due to the fact that in 1950 the pheasants were released 8 days later enabling hunters to bag more of the birds before they fell to predators. In addition, the increased length of the season and more hunting effort probably contributed to the higher kill of released birds in 1950.

It is doubtful if the few pheasants produced by game-farm hens and the additional cocks taken from the summer releases were worth the cost of raising them at the game farm.

Predator Investigation

During the study no evidence was found to indicate that predators were a limiting factor on the Dansville area. It is possible that incidental predator control, i.e. fox hunting, raccoon hunting and the occasional killing of hawks and owls, reduced the predator population on the Dansville area. This is known to be true in the case of foxes. High game populations do not exist at Dansville and therefore predators are not particularly attracted to the area.

Evaluation of Habitat

The soils, vegatative cover, and topography of the Dansville area are typical of areas that are relatively poor pheasant range. However, pheasants are present and due to the extensive cover can hardly be "shot out". Because the pheasant is a much desired game bird and "good pheasant range" open to hunting is not plentiful it is felt that pheasant management is justified on such places as the Dansville area.

Food patches of corn and buckwheat, one to two acres in size, seeded to cover crops should be maintained in the center of the area in as many sites as are suitable. Larger plots of permanent meadow such as alfalfa and brome should be established as near the central parts of the area as possible. Present open areas should be maintained, and cutting done in areas that were open and are now growing up to brush. The addition of grains and field nesting cover should increase the use by pheasants of the central portion of the area for nesting and the rearing of broods, and in turn increase the pheasant carrying capacity of the Dansville area.

Discussion of the Pheasant Population

The differences in the results of the two pheasant inventory estimates, based on (1) field studies and (2) sex ratio change plus the kill, indicates that it is not safe to rely on incomplete data for computing populations. In this case the actual population was not known but was estimated. The kill figure was expanded from known data, estimated to be 80 percent of total, to 100 percent. On an area of approximately

4,500 acres a summer brood census would be adequate for establishing an accurate pre-season population. A post-season and winter census should give population figures with small enough margin of error for a game manager's purpose.

SUMMARY

(1) The study consisted of (a) an inventory of pheasants during the various seasons, (b) appraisal of habitat resources on the Dansville area and comparison with other areas, (c) an effort to obtain as much information as possible regarding the hunting harvest, (d) released pheasants, and (e) the study of predator-pheasant relationships. The purpose of the study was to produce conclusions from the data gathered that might be of value in managing an area such as Dansville for pheasants.

(2) A crowing cock survey was made during the springs of 1949 and 1950, first at four sample stations and later at 29 listening stations located throughout the area. In 1949, 42 crowing cock territories were located while 70 were located in 1950, an increase of 66 percent. In 1950 the four sample areas had a 57 percent increase in crowing frequency per two minute intervals over 1949, while crowings increased 99 percent at the 29 listening stations. State-wide crowing data showed a 39 percent increase. During both years crowing frequencies were generally higher when the temperature was above 39° and when the wind was below 15 miles per hour. Approximately twice as many hens were observed in 1950.

(3) The same search effort during 1949 and in 1950 located 32 pheasant broods for each summer. Two more chicks were seen per brood in 1949 than were recorded in 1950. The size of complete three-quarter

grown broods was the same for each year while complete full-grown broods were larger in 1950. This was believed to be due to the merging of some of the broods in 1950.

The distribution of Dansville hatching in 1949 agreed generally with the time distribution of hatching on other areas. In 1950 there was a double peak in hatching frequency indicating no hatching or loss of broods hatched during the period June 11 - 17.

(4) During the pheasant season of 1949 and 1950 hunters at the Dansville area were interviewed and their game autopsied. There were 65 percent more hunters, 68 percent more hours of hunting, and 20 percent fewer pheasants taken in 1950 than in 1949. More banded game-farm pheasants were taken in 1950, although the same number of pheasants was released during the two years. Approximately the same number of pheasants was observed per 100 hour of hunting for each year. The age ratio was much higher in 1949 than in 1948 indicating production increases. Most of the pheasants were taken during the first week of hunting both years. Game-farm-reared pheasants were taken at a faster rate than were wild pheasants.

Fewer pheasants were shot at Dansville in 1950 than in 1949 as was also the case throughout most of Michigan pheasant range. Hunter success was the same at Rose Lake and better at the Prairie Farm. Hunter success at both Dansville and Rose Lake was poorer both years than at the Prairie Farm. This was expected as the Prairie Farm is considered much better pheasant range.

(5) A few more pheasants were found on the area in the winter of 1950-1951 than in the previous winter. The only pheasant predation evident was by dogs. Live trapping in the summer and winter caught only 12 pheasants and was not considered to be successful.

(6) In the spring of 1949, 150 hens and 14 cocks were marked and released at four different locations on the study area. Twelve percent of the pheasants were recovered as mortalities during the first seven weeks. Because of the extremely heavy cover it is believed that many more died than were found during this period. Released pheasants were not observed after seven weeks until the following spring when four hens were found with broods. None of the cocks were taken during the following hunting season.

There was no significant difference in the number of wild strain cocks and game-farm cocks killed, an equal number of which were released prior to the hunting season. The higher kill in 1950 over 1949 of game-farm pheasants released in equal numbers both years was attributed to the fact that the birds were released eight days later and were not subjected to as much predation before the season and also that more hunters spent more hours searching for pheasants.

(7) During spring and summer 1949 and the fall and winter of 1949-1950, investigations were made of predators and predation on the study area. Dens were investigated and searches were made for nests of predatory birds. Records were kept of mammalian predators observed and their activities. Dogs were known to have killed three pheasants. Some car-

casses and various pheasant remains were found around fox dens. A local trapper stated that about 50 foxes had been taken on the area during the period 1947 through 1949.

(8) A comparison of available food for pheasants on the study area with diets common to pheasants in the northeastern United States show that the Dansville area is lacking in farm crops, such as small grains. A large portion of the area is lowland marsh and woods, and upland woods offering good year around cover but little winter food. The area has only half as many farm crops as adjacent lands, one-sixth as much as typical farmland nearby and one-tenth as much as good pheasant range. Fifty-four percent of the shrubs and 31 percent of the herbs, collected from the higher plants common to the Dansville area, are used for food to some extent by pheasants in the "Lake States" area.

(9) Estimated pre and post-hunting season figures showed a higher population of pheasants in 1950 over 1949. The calculated population, based on change in hunting season sex ratio and pheasant kill, indicated a higher population in 1949. It was calculated that 18 percent more cocks survived the 1950 hunting season than did in 1949.

(10) An accurate spring census of cocks can be made on areas similar to the Dansville game range. The crowing cock census takes less time and effort than actually locating the birds. When the crowing census is made the work should be done under optimum crowing conditions so as to obtain more complete sets of directions which will more nearly represent the entire population.

(11) A possible explanation for the failure of the larger breeding population in 1950 to produce more broods might have been a loss of broods or no hatching for some unknown reason during the period June 9 - 20. The hatching curve shows a gap for that period.

(12) It was shown that a high breeding population does not necessarily result in more pheasant broods.

(13) An accurate brood census is the most reliable method of determining shootable populations in the fall.

(14) The decrease in hunter success in 1950 was due to the increase in hunting pressure when only the same game supply was available. Only one-third as many pheasants were observed for each 100 hours of hunting during both years as were seen on average Michigan pheasant range, indicating a low pheasant population at Dansville. A low proportion of hens to cocks both years as compared to the rest of Michigan pheasant range did not seem favorable to productivity; however, the age ratio was greatly increased in 1949 which shows increase in productivity even though it might not compare to that on the better pheasant ranges.

(15) It is doubtful if short seasons benefit the pheasant population at Dansville as long as only cocks are shot. Between 65 and 70 percent of the total kill was taken the first week. After the first few days so few pheasants were taken that hunting pheasants for sport or meat was hardly worth while. This situation would automatically limit hunting at the Dansville area.

(16) It seems certain that live trapping is not practical on areas having few pheasants and good cover.

(17) Few pheasants survived the 1949 spring release of game-farm birds. More marked pheasants were shot in 1950 probably because of (a) the later release date allowing less time for pre-season predation, and (b) a longer hunting season with more hunting effort.

It is doubtful if the increase in the hunting harvest due to released game-farm birds is worth rearing costs.

(18) There was no evidence that predators were a limiting factor to pheasants at Dansville.

(19) Because of the high demand for the pheasant as a game bird and because "good pheasant range" open to the public is not plentiful, it is thought that pheasant management is justified on such publicly owned pheasant range. Management measures suggested were increases in small grains, herbaceous cover, and the maintenance and creation of openings.

(20) It was determined that the calculating or estimating of pheasant populations was not reliable, at least when data were incomplete or when some of the figures were estimated. A summer brood census and early winter census are more desirable to determine pre and post-hunting season pheasant numbers on small areas.

APPENDIX

TABLE 1

COCK CROWING DATA FROM FOUR SAMPLE AREAS - 1949 AND 1950

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Lienhart Road - Release Site #1 - 1949				
#1	2-5-4-NW	4-14-49	6:03 a.m.	NE 23 T-39°F	1	6:50 a.m.	1	Wind interference
					2	6:55 a.m.	1	
					3	7:00 a.m.	0	
					4	7:05 a.m.	1	
					5	7:10 a.m.	1	
					6	7:15 a.m.	1	
						Av.	.8	
#2	2-5-1-NW	4-14-49	6:03 a.m.	NE 23 T-39°F	1	6:50 a.m.	1	Wind interference
					2	6:55 a.m.	3	
					3	7:00 a.m.	1	
					4	7:05 a.m.	2	
					5	7:10 a.m.	3	
					6	7:15 a.m.	3	
						Av.	2.1	
				Lienhart Road - Release Site #1 - 1950				
#1	2-5-4-NW	4-19-50	5:52 a.m.	WSW 18 T-40°F	1	6:50 a.m.	2	Fair listening
					2	6:55 a.m.	1	
					3	7:00 a.m.	1	
					4	7:05 a.m.	1	
					5	7:10 a.m.	1	
					6	7:15 a.m.	1	
						Av.	1.16	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Lienhart Road - Release Site #1 - 1950				
#2	2-5-1-NW	4-19-50	5:52 a.m.	WSW 16 T-46°F	1 2 3 4 5 6	7:20 a.m. 7:25 a.m. 7:30 a.m. 7:35 a.m. 7:40 a.m. 7:45 a.m.	1 2 2 2 3 1	Fair listening
							Av. 1.8	
				Dexter Trail - Release Site #2 - 1949				
#1	28-14-1-NW	4-12-49	6:05 a.m.	SE 11 T-42°F	1 2 3 4 5	7:10 a.m. 7:15 a.m. 7:20 a.m. 7:25 a.m. 7:30 a.m.	4 4 4 4 3	Good listening
							Av. 3.8	
#1	28-14-1-NW	4-16-49	6:01 a.m.	W 20 T-27°F	1 2 3 4 5 6	7:34 a.m. 7:39 a.m. 7:44 a.m. 7:49 a.m. 7:54 a.m. 7:59 a.m.	0 1 0 2 2 2	Light snow at intervals. Sun visible through thin clouds. Wind interference.
							Av. 1.1	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Dexter Trail - Release Site #2 - 1949				
#1	28-14-1-NW	5-14-49	5:33 a.m.	Negligible T-57°F	1	6:20 a.m.	6	Excellent listening conditions. No wind interference. Some automobile interference.
					2	6:25 a.m.	4	
					3	6:30 a.m.	6	
					4	6:35 a.m.	5	
					5	6:40 a.m.	2	
					6	6:45 a.m.	7	
						Av.	5.0	
#2	28-14-2-NE	4-12-49	6:05 a.m.	SE 11 T-42°F	1	7:12 a.m.	3	Good listening
					2	7:17 a.m.	3	
					3	7:22 a.m.	4	
					4	7:27 a.m.	4	
					5	7:32 a.m.	4	
						Av.	3.6	
#2	28-14-2-NE	4-16-49	6:01 a.m.	W 14 T-28°F	1	7:34 a.m.	1	Light snow at intervals. Sun visible through thin clouds. Wind interference.
					2	7:39 a.m.	4	
					3	7:44 a.m.	0	
					4	7:49 a.m.	2	
					5	7:54 a.m.	1	
					6	7:59 a.m.	2	
						Av.	1.6	
#2	28-14-2-NE	4-17-49	6:10 a.m.	Negligible T-27°F	1	6:15 a.m.	6	Good listening
					2	6:20 a.m.	8	
					3	6:25 a.m.	6	
					4	6:30 a.m.	10	
					5	6:35 a.m.	8	
					6	6:40 a.m.	11	
						Av.	8.1	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Dexter Trail - Release Site #2 - 1949				
#3	28-14-2-NW	4-16-49	6:01 a.m.	W 19 T-27°F	1 2 3 4 5 6	8:10 a.m. 8:15 a.m. 8:20 a.m. 8:25 a.m. 8:30 a.m. 8:35 a.m.	10 4 4 1 1 0	Light snow at intervals. Sky clearing. Wind interference.
							Av. 3.3	
#3	28-14-2-NW	4-20-49	5:57 a.m.	SW 11 T-37°F	1 2 3 4 5 6	5:50 a.m. 5:55 a.m. 6:00 a.m. 6:05 a.m. 6:15 a.m. 6:20 a.m.	10 13 10 11 10 9	Excellent listening
							Av. 10.5	
#3	28-14-2-NW	4-21-49	5:56 a.m.	SW 11 T-46°F	1 2 3 4 5 6	6:05 a.m. 6:10 a.m. 6:15 a.m. 6:20 a.m. 6:25 a.m. 6:30 a.m.	2 6 10 18 13 12	Excellent listening
							Av. 10.1	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Dexter Trail - Release Site #2 - 1949				
#4	28-13-1-NW	4-17-49	6:00 a.m.	Negligible T-27°F	1	6:15 a.m.	5	Good listening
					2	6:20 a.m.	4	
					3	6:25 a.m.	3	
					4	6:30 a.m.	5	
					5	6:35 a.m.	4	
					6	6:40 a.m.	3	
						Av.	4	
#4	28-13-1-NW	4-20-49	5:57 a.m.	SW 16 T-37°F	1	6:25 a.m.	4	Wind interfered somewhat at this station
					2	6:30 a.m.	4	
					3	6:35 a.m.	8	
					4	6:40 a.m.	3	
					5	6:45 a.m.	7	
					6	6:50 a.m.	2	
						Av.	4.6	
#4	28-13-1-NW	5-14-49	5:33 a.m.	Negligible T-40°F	1	5:42 a.m.	5	Excellent listening
					2	5:47 a.m.	7	
					3	5:52 a.m.	6	
					4	5:57 a.m.	12	
					5	6:02 a.m.	6	
					6	6:07 a.m.	3	
						Av.	6.5	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Dexter Trail - Release Site #2 - 1950				
#1	28-14-1-NW	4-23-50	5:45 a.m.	NE 12.5 T-44°F	1	6:50 a.m.	5	Good listening
					2	6:55 a.m.	5	
					3	7:00 a.m.	5	
					4	7:05 a.m.	6	
					5	7:10 a.m.	5	
					6	7:15 a.m.	6	
						Av.	5.3	
#1	28-14-1-NW	4-16-50	5:56 a.m.	WSW 12.9 Approx. T-32°F	1	5:22 a.m.	7	Good listening
					2	5:27 a.m.	8	
					3	5:32 a.m.	5	
					4	5:37 a.m.	6	
					5	5:42 a.m.	2	
					6	5:47 a.m.	2	
						Av.	5	
#1	28-14-1-NW	4-17-50	5:54 a.m.	W 16 T-54°F	1	6:24 a.m.	7	A little wind interference
					2	6:29 a.m.	8	
					3	6:34 a.m.	7	
					4	6:39 a.m.	7	
					5	6:44 a.m.	5	
					6	6:49 a.m.	7	
						Av.	6.8	
#2	28-14-2-NE	4-17-50	5:54 a.m.	W 16 T-56°F	1	7:01 a.m.	8	A little wind interference
					2	7:06 a.m.	7	
					3	7:12 a.m.	16	
					4	7:17 a.m.	8	
					5	7:22 a.m.	15	
					6	7:27 a.m.	7	
						Av.	10.1	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency		Notes
				Dexter Trail - Release Site #2 - 1950					
#2	28-14-2-NE	4-15-50	5:57 a.m.	WNW 11.5 T-25°F	1	7:01 a.m.		3	Some wind interference
					2	7:06 a.m.		4	
					3	7:11 a.m.		2	
					4	7:16 a.m.		3	
					5	7:21 a.m.		2	
					6	7:26 a.m.		4	
							Av.	3	
#2	28-14-2-NE	4-15-50	5:57 a.m.	WNW 11.5 T-28°F	1	7:35 a.m.		2	Good listening
					2	7:40 a.m.		2	
					3	7:45 a.m.		3	
					4	7:50 a.m.		6	
					5	7:55 a.m.		3	
					6	8:00 a.m.		5	
							Av.	3.5	
#3	28-14-2-NW	4-25-50	5:42 a.m.	ENE 20 T-40°F	1	5:03 a.m.		4	Some wind interference
					2	5:08 a.m.		7	
					3	5:13 a.m.		6	
					4	5:18 a.m.		6	
					5	5:23 a.m.		7	
					6	5:28 a.m.		5	
							Av.	5.8	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Dexter Trail - Release Site #2 - 1950				
#3	28-14-2-NW	4-25-50	5:42 a.m.	ENE 20	1	5:40 a.m.	4	Some wind interference
				T-43°F	2	5:45 a.m.	6	
					3	5:50 a.m.	7	
					4	5:55 a.m.	5	
					5	6:00 a.m.	4	
					6	6:05 a.m.	3	
						Av.	4.8	
#3	28-14-2-NW	4-27-50	5:39 a.m.	WSW 15	1	5:45 a.m.	6	Good listening
				T-35°F	2	5:50 a.m.	14	
					3	5:55 a.m.	7	
					4	6:00 a.m.	7	
					5	6:05 a.m.	13	
					6	6:10 a.m.	6	
						Av.	8.8	
#4	28-13-1-NW	4-27-50	5:39 a.m.	WSW 15	1	6:23 a.m.	5	Fair listening
				T-35°F	2	6:28 a.m.	5	
					3	6:33 a.m.	4	
					4	6:38 a.m.	5	
					5	6:43 a.m.	4	
					6	6:48 a.m.	4	
						Av.	4.5	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Dexter Trail - Release Site #2 - 1950				
#4	28-13-1-NW	4-26-50	5:40 a.m.	SW 20 T-37°F	1	6:05 a.m.	5	Some wind interference
					2	6:10 a.m.	6	
					3	6:15 a.m.	7	
					4	6:20 a.m.	6	
					5	6:25 a.m.	0	
					6	6:30 a.m.	9	
						Av.	5.5	
#4	28-13-1-NW	4-26-50	5:40 a.m.	SW 20 T-37°F	1	6:42 a.m.	5	
					2	6:47 a.m.	3	
					3	6:52 a.m.	7	
					4	6:57 a.m.	7	
					5	7:02 a.m.	8	
					6	7:07 a.m.	7	
						Av.	6.2	
				Seven Gables - Release Site #3 - 1949				
#1	34-4-4-NW	4-14-49	6:03 a.m.	NE 23 T-40°F	1	5:50 a.m.	4	Wind interference
					2	5:55 a.m.	6	
					3	6:00 a.m.	3	
					4	6:05 a.m.	5	
					5	6:10 a.m.	5	
					6	6:15 a.m.	8	
						Av.	5.1	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Seven Gables - Release Site #3 - 1949				
#1	34-4-4-NW	4-16-49	6:01 a.m.	W 19 T-27°F	1 2 3 4 5 6	8:50 a.m. 8:55 a.m. 9:00 a.m. 9:05 a.m. 9:10 a.m. 9:15 a.m.	0 0 0 1 1 1 Av. .5	Wind interference
#2	34-5-2-NW	4-14-49	6:03 a.m.	NE 23 T-40°F	1 2 3 4 5 6	5:50 a.m. 5:55 a.m. 6:00 a.m. 6:05 a.m. 6:10 a.m. 6:15 a.m.	5 4 2 2 3 3 Av. 3.1	Wind interference
#2	34-5-2-NW	4-16-49	6:01 a.m.	W 19 T-27°F	1 2 3 4 5 6	8:50 a.m. 8:55 a.m. 9:00 a.m. 9:05 a.m. 9:10 a.m. 9:15 a.m.	0 0 0 1 2 1 Av. .7	Wind interference

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Seven Gables - Release Site #3 - 1950				
#1	34-4-4-NW	4-11-50	6:04 a.m.	W 30 T-41°F	1 2 3 4 5 6	5:45 a.m. 5:50 a.m. 5:55 a.m. 6:00 a.m. 6:05 a.m. 6:10 a.m.	3 7 3 6 6 7	Fair listening. Wind interference
							Av. 5.3	
#1	34-4-4-NW	4-12-50	6:02 a.m.	WNW 17 T-25°F	1 2 3 4 5 6	8:50 a.m. 8:55 a.m. 9:00 a.m. 9:05 a.m. 9:10 a.m. 9:15 a.m.	1 2 1 2 1 1	A little wind interference
							Av. 1.3	
#2	34-5-2-NW	4-11-50	6:04 a.m.	W 30 T-41°F	1 2 3 4 5 6	5:45 a.m. 5:50 a.m. 5:55 a.m. 6:00 a.m. 6:05 a.m. 6:10 a.m.	7 3 3 2 4 3	Only fair listening. Wind interference.
							Av. 3.6	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Seven Gables - Release Site #3 - 1950				
#2	34-5-2-NW	4-12-50	6:02 a.m.	WNW 17	1	8:50 a.m.	1	A little wind
				T-25°F	2	8:55 a.m.	0	interference
					3	9:00 a.m.	1	
					4	9:05 a.m.	2	
					5	9:10 a.m.	1	
					6	9:15 a.m.	2	
						Av.	1.2	
				Potter Road - Release Site #4 - 1949				
#1	5-1-2-SW	4-12-49	6:05 a.m.	SE 10	1	5:55 a.m.	10	Good listening
				T-40°F	2	6:00 a.m.	13	
					3	6:05 a.m.	-	
					4	6:10 a.m.	-	
					5	6:15 a.m.	3	
					6	6:20 a.m.	3	
						Av.	7.2	
#1	5-1-2-SW	4-16-49	6:01 a.m.	W 18	1	6:08 a.m.	2	Wind interfered
				T-27°F	2	6:13 a.m.	0	somewhat with good
					3	6:18 a.m.	0	hearing
					4	6:23 a.m.	1	
					5	6:28 a.m.	1	
					6	6:33 a.m.	1	
						Av.	.8	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Potter Road - Release Site #4 - 1949				
#2	5-2-1-NE	4-12-49	6:05 a.m.	SE 10 T-40°F	1 2 3 4 5 6	5:55 a.m. 6:00 a.m. 6:05 a.m. 6:10 a.m. 6:15 a.m. 6:20 a.m.	9 9 5 3 5 9	Good listening
							Av. 6.6	
#2	5-2-1-NE	4-16-49	6:01 a.m.	W 15 T-27°F	1 2 3 4 5 6	6:08 a.m. 6:13 a.m. 6:18 a.m. 6:23 a.m. 6:28 a.m. 6:33 a.m.	1 2 1 1 3 1	Wind interfered somewhat with good hearing
							Av. 1.5	
#2	5-2-1-NE	4-26-49	5:51 a.m.	W 20 T-60°F	1 2 3 4 5 6	6:05 a.m. 6:10 a.m. 6:15 a.m. 6:20 a.m. 6:25 a.m. 6:30 a.m.	2 1 1 0 0 1	Wind interference
							Av. .8	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Potter Road - Release Site #4 - 1949					
#3	32-16-3-NW	4-23-49	5:54 a.m.	W 30 T-46°F	1 2 3 4 5 6	6:05 a.m. 6:10 a.m. 6:15 a.m. 6:20 a.m. 6:25 a.m. 6:30 a.m.	2 1 1 0 0 1	Wind interference
							Av. .8	
#3	32-16-3-NW	4-23-49	5:54 a.m.	W 30 T-46°F	1 2 3 4 5 6	6:02 a.m. 6:07 a.m. 6:12 a.m. 6:17 a.m. 6:22 a.m. 6:27 a.m.	4 2 7 6 4 3	Wind interference
							Av. 4.3	
#4	32-15-4-NW	4-23-49	5:54 a.m.	W 30 T-46°F	1 2 3 4 5 6	6:35 a.m. 6:40 a.m. 6:45 a.m. 6:50 a.m. 6:55 a.m. 7:00 a.m.	1 2 4 4 3 1	Wind interference
							Av. 2.5	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Potter Road - Release Site #4 - 1949				
#5	32-16-2-NW	4-26-49	5:51 a.m.	W 25	1	6:05 a.m.	2	Wind interference
				T-60°F	2	6:10 a.m.	0	
					3	6:15 a.m.	2	
					4	6:20 a.m.	1	
					5	6:25 a.m.	0	
					6	6:30 a.m.	0	
						Av.	.8	
				Potter Road - Release Site #4 - 1950				
#1	5-1-2-SW	4-21-50	5:48 a.m.	W 11	1	5:40 a.m.	7	Good listening
				T-35°F	2	5:45 a.m.	4	
					3	5:50 a.m.	8	
					4	5:55 a.m.	7	
					5	6:00 a.m.	8	
					6	6:05 a.m.	8	
						Av.	7	
#1	5-1-2-SW	4-21-50	5:48 a.m.	W 11	1	6:11 a.m.	6	Good listening
				T-36°F	2	6:16 a.m.	6	
					3	6:21 a.m.	7	
					4	6:26 a.m.	5	
					5	6:31 a.m.	8	
					6	6:36 a.m.	9	
						Av.	6.8	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
				Potter Road - Release Site #4 - 1950				
#2	5-2-1-NE	4-21-50	5:48 a.m.	W 11 T-39°F	1 2 3 4 5 6	6:42 a.m. 6:47 a.m. 6:52 a.m. 6:57 a.m. 7:02 a.m. 7:07 a.m.	5 6 5 8 6 5	Good listening
							Av. 5.8	
#2	5-2-1-NE	4-20-50	5:49 a.m.	W 16 T-37°F	1 2 3 4 5 6	5:56 a.m. 6:01 a.m. 6:06 a.m. 6:11 a.m. 6:16 a.m. 6:21 a.m.	0 3 2 4 4 3	Some wind interference
							Av. 2.6	
#2	5-2-1-NE	4-30-50	5:35 a.m.	ENE 15 T-40°F	1 2 3 4 5 6	5:46 a.m. 5:51 a.m. 5:56 a.m. 6:01 a.m. 6:06 a.m. 6:11 a.m.	13 11 10 12 4 5	
							Av. 15.7	

Station	Location	Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Potter Road - Release Site #4 - 1950					
#3	32-16-3-NW	4-30-50	5:35 a.m.	ENE 15 T-43°F	1	6:21 a.m.	14	
					2	6:26 a.m.	8	
					3	6:31 a.m.	15	
					4	6:36 a.m.	6	
					5	6:41 a.m.	5	
					6	6:46 a.m.	7	
							Av. 9.1	
#4	32-15-4-NW	4-29-50	5:36 a.m.	ENE 15 T-40°F	1	6:33 a.m.	3	
					2	6:38 a.m.	3	
					3	6:43 a.m.	4	
					4	6:48 a.m.	5	
					5	6:53 a.m.	4	
					6	6:58 a.m.	6	
							Av. 4	
#5	32-16-2-NW	4-29-50	5:36 a.m.	ENE 15 T-40°F	1	7:08 a.m.	5	
					2	7:13 a.m.	4	
					3	7:18 a.m.	4	
					4	7:23 a.m.	6	
					5	7:28 a.m.	6	
					6	7:33 a.m.	5	
							Av. 5	

TABLE 2

CROWING DATA FROM 29 LISTENING STATIONS, 1949 AND 1950

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #1 - 1949			
4-28-49	5:38 a.m.	ENE 20 T-38°F	1	5:33 a.m.	9	A little wind interference
			2	5:38 a.m.	4	
			3	5:43 a.m.	12	
				Av.	8.1	
4-26-49	5:40 a.m.	SSW 19 T-57°F	1	7:15 a.m.	1	
			Station #1 - 1950			
5-5-50	5:28 a.m.	SE 23 T-54°F	1	5:30 a.m.	9	A little wind interference
			2	5:35 a.m.	8	
			3	5:40 a.m.	9	
			4	5:45 a.m.	10	
			5	5:50 a.m.	9	
				Av.	9	
			Station #2 - 1949			
4-26-49	5:40 a.m.	SSW 20 T-59°F	1	7:03 a.m.	3	
			2	7:09 a.m.	4	
				Av.	3.5	
			Station #2 - 1950			
5-5-50	5:28 a.m.	SE 23 T-55°F	1	6:00 a.m.	4	Some wind interference
			2	6:06 a.m.	5	
			3	6:11 a.m.	4	
			4	6:16 a.m.	4	
			5	6:21 a.m.	3	
				Av.	4	
			Station #3 - 1949			
4-26-49	5:40 a.m.	SSW 20 T-59°F	1	7:09 a.m.	1	Wind interference
			2	7:12 a.m	2	
				Av.	1.5	

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #3 - 1950			
5-5-50	5:28 a.m.	SE 24 T-55°F	1	6:29 a.m.	3	A little wind interference
			2	6:34 a.m.	2	
			3	6:39 a.m.	4	
			4	6:44 a.m.	2	
			5	6:49 a.m.	5	
				Av.	3.2	
			Station #4 - 1949			
5-31-49	5:03 a.m.	SW 11 T-59°F	1	6:08 a.m.	3	
			2	6:13 a.m.	3	
			3	6:18 a.m.	5	
			4	6:23 a.m.	2	
				Av.	3.2	
			Station #4 - 1950			
5-5-50	5:28 a.m.	SE 24 T-57°F	1	6:55 a.m.	3	Wind interference
			2	7:00 a.m.	2	
			3	7:05 a.m.	1	
			4	7:10 a.m.	2	
			5	7:15 a.m.	0	
				Av.	1.6	
			Station #5 - 1949			
4-26-49	5:51 a.m.	W 20 T-60°F	1	6:05 a.m.	2	Wind interference
			2	6:10 a.m.	1	
			3	6:15 a.m.	1	
			4	6:20 a.m.	0	
			5	6:25 a.m.	0	
			6	6:30 a.m.	1	
				Av.	.8	
4-23-49	5:54 a.m.	W 28 T-46°F	1	6:02 a.m.	4	Wind interference
			2	6:07 a.m.	2	
			3	6:12 a.m.	7	
			4	6:17 a.m.	6	
			5	6:22 a.m.	4	
			6	6:27 a.m.	3	
				Av.	4.3	

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #5 - 1950			
5-6-50	5:27 a.m.	WSW 30 T-58°F	1	5:30 a.m.	0	Wind interference
			2	5:36 a.m.	4	
			3	5:41 a.m.	4	
			4	5:46 a.m.	5	
			5	5:51 a.m.	6	
				Av.	3.8	
5-6-50	5:27 a.m.	WSW 30 T-58°F	1	5:57 a.m.	5	Wind interference
			2	6:02 a.m.	1	
			3	6:07 a.m.	7	
			4	6:12 a.m.	6	
			5	6:17 a.m.	4	
				Av.	4.6	
			Station #6 - 1949			
5-5-49	5:28 a.m.	SW 15 T-68°F	1	6:11 a.m.	8	Fair listening
			Station #6 - 1950			
5-10-50	5:22 a.m.	W 18 T-47°F	1	5:18 a.m.	9	A little wind
			2	5:23 a.m.	8	interference
				Av.	8.5	
			Station #7 - 1949			
5-19-49	5:12 a.m.	S 18 T-67°F	1	6:20 a.m.	8	
			Station #7 - 1950			
5-10-50	5:22 a.m.	W 18 T-47°F	1	5:30 a.m.	7	A little wind
			2	5:35 a.m.	8	interference
				Av.	7.5	
			Station #8 - 1949			
5-19-49	5:12 a.m.	S 21 T-67°F	1	6:31 a.m.	7	A little wind interference

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #8 - 1950			
5-10-50	5:22 a.m.	W 18 T-47°F	1 2	5:44 a.m. 5:59 a.m.	7 12	Fair listening
				Av.	9.5	
			Station #9 - 1949			
5-31-49	5:03 a.m.	SW 17 T-60°F	1 2 3 4 5	5:31 a.m. 5:36 a.m. 5:41 a.m. 5:46 a.m. 5:53 a.m.	2 0 2 3 4	Good listening
				Av.	2.2	
			Station #9 - 1950			
5-10-50	5:22 a.m.	W 18 T-49°F	1 2 3	5:56 a.m. 6:01 a.m. 6:06 a.m.	8 9 10	Fair listening
				Av.	9	
			Station #10 - 1949			
5-30-49	4:04 a.m.	S 10 T-50°F	1 2 3 4 5	6:00 a.m. 6:05 a.m. 6:10 a.m. 6:15 a.m. 6:20 a.m.	6 4 7 3 4	Good listening
				Av.	4.8	
			Station #10 - 1950			
5-28-50	5:05 a.m.	N 8 T-49°F	1 2 3	5:19 a.m. 5:25 a.m. 5:29 a.m.	6 7 7	Good listening
				Av.	6.6	
			Station #11 - 1949			
5-30-49	5:04 a.m.	S 10 T-55°F	1 2 3 4 5	5:32 a.m. 5:37 a.m. 5:42 a.m. 5:47 a.m. 5:53 a.m.	3 9 4 2 7	Good listening
				Av.	5	

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #11 - 1950			
5-28-50	5:05 a.m.	N 8 T-49°F	1 2 3	5:37 a.m. 5:42 a.m. 5:47 a.m.	5 7 8	Good listening
				Av.	6.6	
			Station #12 - 1949			
5-3-49	5:31 a.m.	SW 19 T-53°F	1	6:51 a.m.	5	A little wind interference
			Station #12 - 1950			
5-2-50	5:32 a.m.	ENE 10 T-37°F	1 2 3	5:18 a.m. 5:23 a.m. 5:28 a.m.	6 7 13	Good listening
				Av.	8.6	
			Station #13 - 1949			
5-3-49	5:31 a.m.	SW 16 T-51°F	1	6:38 a.m.	4	Fair listening
			Station #13 - 1950			
5-2-50	5:32 a.m.	ENE 10 T-37°F	1 2 3	5:35 a.m. 5:40 a.m. 5:45 a.m.	6 11 7	Good listening
				Av.	8	
			Station #14 - 1949			
5-3-49	5:31 a.m.	SW 16 T-53°F	1	7:05 a.m.	8	Fair listening
			Station #14 - 1950			
5-2-50	5:32 a.m.	ENE 10 T-37°F	1 2 3	5:53 a.m. 5:58 a.m. 6:03 a.m.	7 11 11	Good listening
				Av.	9.7	

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #15 - 1949			
5-3-49	5:31 a.m.	SW 16 T-53°F	1	7:14 a.m.	8	Good listening
			Station #15 - 1950			
5-4-50	5:29 a.m.	NE 11 T-55°F	1	5:10 a.m.	9	Good listening
			2	5:15 a.m.	16	
			3	5:20 a.m.	11	
				Av.	12	
			Station #16 - 1949			
5-3-49	5:31 a.m.	SW 16 T-53°F	1	7:22 a.m.	3	Fair listening
5-5-49	5:28 a.m.		1	5:56 a.m.	2	Wind interference
			2	6:01 a.m.	0	
				Av.	1	
			Station #16 - 1950			
5-4-50	5:29 a.m.	NE 11 T-55°F	1	5:27 a.m.	6	Good listening
			2	5:32 a.m.	8	
			3	5:37 a.m.	13	
				Av.	9	
			Station #17 - 1949			
5-5-49	5:28 a.m.	SW 24 T-68°F	1	6:08 a.m.	4	Car interference
			2	6:13 a.m.	1	and a little wind
				Av.	2.5	interference
			Station #17 - 1950			
5-4-50	5:29 a.m.	NE 11 T-55°F	1	5:43 a.m.	7	Good listening
			2	5:48 a.m.	8	
			3	5:53 a.m.	8	
				Av.	7.7	

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #18 - 1949			
5-27-49	5:06 a.m.	WNW 13 T-43°F	1 2 3 4	5:40 a.m. 5:45 a.m. 5:50 a.m. 5:55 a.m.	0 2 2 1	
				Av.	1.2	
			Station #18 - 1950			
5-4-50	5:29 a.m.	NE 11 T-55°F	1 2 3	5:57 a.m. 6:02 a.m. 6:07 a.m.	3 0 8	Good listening
				Av.	3.7	
			Station #19 - 1949			
4-28-49	5:38 a.m.	E 20 T-38°F	1 2 3	6:47 a.m. 6:52 a.m. 6:57 a.m.	2 2 3	A little wind interference
				Av.	2.3	
5-5-49	5:28 a.m.	SW 24 T-68°F	1	6:34 a.m.	5	Wind interference
			Station #19 - 1950			
5-8-50	5:24 a.m.	ESE 15 T-43°F	1 2 3	5:15 a.m. 5:20 a.m. 5:26 a.m.	5 5 5	
				Av.	5	
			Station #20 - 1949			
4-28-49	5:38 a.m.	E 20 T-38°F	1 2 3	7:11 a.m. 7:16 a.m. 7:21 a.m.	0 1 1	A little wind interference
				Av.	.66	
			Station #20 - 1950			
5-8-50	5:24 a.m.	ESE 15 T-43°F	1 2 3	5:33 a.m. 5:38 a.m. 5:43 a.m.	6 8 7	
				Av.	7	

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #21 - 1949			
4-14-49	5:52 a.m.	ENE 21 T-40°F	1 2 3 4 5 6	5:50 a.m. 5:55 a.m. 6:00 a.m. 6:05 a.m. 6:10 a.m. 6:15 a.m.	4 6 3 5 5 8 Av. 5.1	
4-14-49	5:59 a.m.	ENE 21 T-40°F	1 2 3 4 5 6	5:52 a.m. 5:57 a.m. 6:02 a.m. 6:07 a.m. 6:12 a.m. 6:17 a.m.	4 5 1 3 4 3 Av. 3.3	A little wind interference
			Station #21 - 1950			
4-17-50	5:54 a.m.	W 16 T-54°F	1 2 3 4 5 6	6:24 a.m. 6:29 a.m. 6:34 a.m. 6:39 a.m. 6:44 a.m. 6:49 a.m.	7 8 7 7 5 7 Av. 6.8	A little wind interference
4-17-50	5:54 a.m.	W 16 T-56°F	1 2 3 4 5 6	7:01 a.m. 7:06 a.m. 7:12 a.m. 7:17 a.m. 7:22 a.m. 7:27 a.m.	8 7 6 8 5 7 Av. 6.8	A little wind interference
			Station #22 - 1949			
4-28-49	5:38 a.m.	NE 20 T-38°F	1 2 3	7:34 a.m. 7:39 a.m. 7:44 a.m.	2 1 1 Av. 1.3	A little wind interference
5-8-49	5:24 a.m.	NE 9 T-42°F	1 2 3	6:28 a.m. 6:33 a.m. 6:38 a.m.	1 2 5 Av. 2.6	Good listening

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #22 - 1950			
5-12-50	5:19 a.m.	SW 14 T-49°F	1 2 3	5:17 a.m. 5:22 a.m. 5:27 a.m.	4 7 8	Fair listening
					Av. 6.3	
			Station #23 - 1949			
5-7-49	5:25 a.m.	NE 19 T-49°F	1	6:33 a.m.	0	A little wind interference
5-8-49	5:24 a.m.	NE 9 T-43°F	1 2 3	6:38 a.m. 6:43 a.m. 6:48 a.m.	2 3 3	Good listening
					Av. 2.6	
			Station #23 - 1950			
5-12-50	5:19 a.m.	SW 14 T-49°F	1 2 3	5:34 a.m. 5:39 a.m. 5:44 a.m.	2 4 2	Fair listening
					Av. 2.6	
			Station #24 - 1949			
6-1-49	4:03 a.m.	SE 17 T-54°F	1 2 3 4 5	5:55 a.m. 6:00 a.m. 6:05 a.m. 6:10 a.m. 6:15 a.m.	4 2 2 3 2	A little wind interference
					Av. 2.6	
			Station #24 - 1950			
5-29-50	5:04 a.m.	ENE 8 T-59°F	1 2 3	5:00 a.m. 5:05 a.m. 5:10 a.m.	6 7 7	Good listening
					Av. 6.6	
			Station #25 - 1949			
5-23-49	5:09 a.m.	SW 15 T-53°F	1 2 3 4 5	6:20 a.m. 6:25 a.m. 6:30 a.m. 6:35 a.m. 6:40 a.m.	4 0 2 6 4	Fair listening
					Av. 3.2	

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #25 - 1950			
5-29-50	5:04 a.m.	ENE 8 T-59°F	1 2 3	5:21 a.m. 5:26 a.m. 5:31 a.m.	5 3 7	Good listening
					Av. 5	
			Station #26 - 1949			
5-23-49	5:09 a.m.	WSW 14 T-approx. 60°F	1 2 3 4 5	5:50 a.m. 5:55 a.m. 6:00 a.m. 6:05 a.m. 6:10 a.m.	3 6 5 5 2	Good listening
					Av. 4.2	
			Station #26 - 1950			
5-23-50	5:09 a.m.	W 8 T-58°F	1 2 3	4:48 a.m. 4:53 a.m. 4:58 a.m.	7 9 10	Good listening
					Av. 8.6	
			Station #27 - 1949			
5-28-49	5:05 a.m.	NNW 12 T-40°F	1 2 3	6:17 a.m. 6:22 a.m. 6:27 a.m.	6 2 4	No interference
					Av. 4	
			Station #27 - 1950			
5-23-50	5:09 a.m.	W 8 T-58°F	1 2 3	5:05 a.m. 5:10 a.m. 5:15 a.m.	14 9 8	No interference
					Av. 10.3	
			Station #28 - 1949			
4-28-49	5:38 a.m.	E 15 T-38°F	1 2 3	5:54 a.m. 5:59 a.m. 6:04 a.m.	0 4 4	A little wind interference
					Av. 2.6	

Date	Sunrise	Wind & Temp.	Count No.	Time	Frequency	Notes
			Station #28 - 1950			
5-7-50	5:25 a.m.	NNW 15 T-44°F	1 2 3	5:19 a.m. 5:25 a.m. 5:30 a.m.	9 7 11	A little wind interference
					Av. 9	
			Station #29 - 1949			
5-23-49	5:09 a.m.	WSW 14 T-57°F	1 2 3	5:35 a.m. 5:40 a.m. 5:45 a.m.	7 6 4	
					Av. 5.66	
			Station #29 - 1950			
5-25-50	5:42 a.m.	SSE 14 T-67°F	1 2 3	5:32 a.m. 5:37 a.m. 5:43 a.m.	14 9 13	
					Av. 12	

TABLE 3

OBSERVATIONS OF RELEASED BIRDS AND MORTALITIES

Mortalities - Area #1 - Seven Gables Road

Number	Date	Location	Description
1	April 3	34-5-1-NE	Female, yellow band #204, found dead. A small amount of flesh removed from back. Exact cause unknown.
2	April 3-11	33-7-2-SE	Female, feathers only. Cause of death unknown. Someone had marked previously.
3	April 3-11	34-5-1-NE	Female, many feathers. Possible owl kill.
4	April 6	33-9-1-SW	Hen with yellow band #108 and eosin dyed feathers was found killed and mostly eaten. Feathers first observed on the road, remains of bird found in edge of woodlot.
5	April 9	33-8-1-SE	Cock #118769 found in a dead furrow 40 yards from hedgerow. Head, neck torn open, a three-quarter inch slit under left wing. A possible weasel kill.
6	April 5	34-4-4-NW	White mutant cock found at edge of swale. Cause of death - predator.
7	April 4-12	27-10-4-NE	Female #118810 - yellow #109. Freshly killed on Williamston Rd.
8	April 23	33-2-1-NW	Female, no band, eosin dye on feathers. Found along fence behind barn on Seven Gables Road. Predator unknown.
9	May 13	33-7-1-SW	Cock #116909, found near marsh boundary. Carcass intact, found 50 yards from fox den, known to have been occupied recently. Fox tracks at den entrance.

Number	Date	Location	Description
10	May 14	33-4-1-SE	Female, or females, no bands. Found at edge of field near game trail leading to den with two entrances under windfall. Feathers in field and trail of feathers to den. Feathers and bones around and in opening. No odor. Tracks noted, not identified.
11	April 3-9	33-1-3-SE	Female #118791 - yellow #240.

Suspected Mortalities - Seven Gables Area #1

Number	Location	Description
1	34-5-4-NE	Female, feathers found
2	34-5-3-SW	Female, feathers found
3	34-5-1-NE	Female, feathers found
4	34-4-3-SE	Cock, feathers found
5	33-8-4-SW	Cock, feathers found
6	33-8-3-SW	Female, feathers found
7	33-8-3-SW	Female, feathers found
8	33-8-3-SW	Female, feathers found
9	33-7-2-SE	Female, feathers found

Old Mortalities

A number of pheasants were found that appeared to have been dead since last fall. These are listed below with their locations. Bones were bleached and feathers badly weathered. Most of the carcasses were intact.

Number	Location	Description
1	33-8-1-NW	Female
2	33-8-2-SE	Female
3	33-8-3-NW	Cock
4	33-7-4-NE	Female
5	33-7-4-SW	Female
6	33-7-1-SE	Female
7	33-1-2-SW	Female
8	33-1-3-NW	Female, Band #110706
9	33-2-1-SE	Female

Observations of Released Pheasants

Seven Gables Release Area #1

Observations of released birds are listed below as nearly as possible according to date, location and significant remarks.

Number	Date	Location	Remarks
1	April 2	34-4-2-NW	White Mutant Cock on road, later roosting in brush.
2	April 2	34-5-2-SW	Female flushed from sedges.
3	April 2	Unknown	Hens flushed only when in danger of being stepped on even when in scanty cover.
4	April 2	Unknown	
5	April 2	Unknown	
6	April 2	Unknown	
7	April 2	Unknown	

Number	Date	Location	Remarks
8	April 2	34-4-3-SW	Observed white cock on Seven Gables Road. Chased him 20 yards before he flushed. The pheasant flew northeast 100 yards and landed in marsh.
9	April 9	33-8-3-SW	Observed wild cock and two released hens. Eosin dye identified. Cock flushed into marsh immediately. Hens ran into marsh.
10	Unknown	Unknown	Cock
11	Unknown	Unknown	Hen
12	Unknown	Unknown	Hen
13	Unknown	Unknown	Hen
14	Unknown	Unknown	Hen
15	Unknown	Unknown	Hen
16	Unknown	Unknown	Hen
17	April 10	34-5-3-SE	Hen
18	April 10	34-5-3-SE	Hen
19	April 10	34-5-3-SE	Hen
20	May 16	33-8-2-SW	Hen. Approached within 3 feet at edge of marsh. Eosin dye visible on back. Flew northwest into swale.

Summary of mortalities, possible mortalities, old mortalities, and observations of live released birds in the vicinity of the Seven Gables release site:

Mortalities - 11 (3 males including 1 white male. Male #116909 probably from previous release - 9 females)

Possible Mortalities - 9 (2 males - 7 females)

Old Mortalities - 9 (1 male - 8 females)

Observations of living released birds - 20
(3 males - including 1 white cock
observed twice - 17 females)

Mortalities at Release Area #2 - Lienhart Road

Number	Date	Location	Description
1	April 6	2-5-1-NE	Hen, many feathers, bones, plucked fairly clean. Green dye present on the feathers found in marsh.

Possible Mortalities at Release Area #2

1	April 5	2-5-1-SE	Three or 4 feathers seen at edge of marsh. Area searched. Feather trail led into water area 3 feet deep.

Old Mortalities - None

Observations of Released Pheasants

Lienhart Road Release Area #2

1	April 2	2-5-4-NE	Hen flushed from marsh grass, flew into adjacent woods on the east. Eosin dye observed. Approached to within 15 feet before the bird flushed.
2	April 2	2-5-1-NE	Same as above, birds were together, flushed in the same direction, eosin dye observed.
3	April 2	2-5-1-NE	Hen, eosin dye observed, at border of marsh and woods, flew west from marsh to hay field. Approached to within 20 feet before bird flushed. Ran 10 yards before flying; fair flyer.

Number	Date	Location	Description
4	April 2	2-6-3-NW	Hen, eosin dye observed, bird in marsh when flushed; approached to within 20 feet before flushing, difficult take off. Bird ran 5 yards before flying. Flew east to woods 40 to 50 yards, landed; fair flyer.
5	April 2	2-6-3-NW	Hen, in bottomland woods, attempted to fly but could not. Ran NE into the woods. Approached to within 25 feet before it flushed.
6	April 2	2-6-2-SW	Hen, eosin dye observed. The bird was in woodlot hiding under a fallen branch and did not flush until the observer was within 3 feet. Did not attempt to fly, instead ran through the brush into the woods.
7	April 2	2-6-2-SW	Hen, unable to identify eosin stain; running 30 yards in front of observer in woodlot when seen. Flew after a 20 yard run; flew SW.
8	April 2	2-5-1-NE	Eosin dye observed. Hen. Heard loud cackling in marsh, upon approach a cock flushed, flew NE over tall trees, flew fast and well. (A wild cock) none of the released cocks flew well. At same time, a hen was observed running in grass, attempted to fly, only bounced off ground for a short distance, left tail feathers were missing.
9	April 2	2-5-1-NE	Eosin dye observed. Hen, sitting in marsh grass; noticed because of dye. Approached to within one foot before it flushed, a fair flyer.

This area was not included in the principle study area. Relatively little time was spent in searching for mortalities after the first six days.

Summary of mortalities, possible mortalities, old mortalities and observations of live released birds in the vicinity of the Lienhart Road release site:

Mortalities - 1 (hen)

Possible mortalities - 0

Old mortalities - 0

Observations of living released birds - 9 (hens)

Observations of Released Birds and Mortalities

Mortalities - Area #3 - Dexter Trail

Number	Date	Location	Description
1	April 3	28-14-2-SE	Half-eaten hen found 20 feet from edge of field in the marsh. It was not stained or banded with colored band. Was an escapee. Band #118927.
2	April 7	28-14-2-SW	Cock. Found body feathers and tail feathers within a small radius. Two released cocks were known to have roosted in this vicinity on April 2.
3	April 10	28-11-1-SE	Hen. Band #118845. Red band #225.

Possible Mortalities at Release Area #3 - None

Old Mortalities

1	April 7	28-11-3, 28-11-4 (no exact location in records)
2	April 7	28-11-3, 28-11-4 (no exact location in records)
3	April 7	28-11-3, 28-11-4 (no exact location in records)
4	April 7	28-11-3, 28-11-4 (no exact location in records)

Observations of Released Pheasants

Dexter Trail Release Area #3

Number	Date	Location	Remarks
1	April 2	28-14-1-NW	Hen. Eosin dye observed. Observed at edge of swale in marsh grass. Approached to within 4 feet before it flushed. Flew fairly well to the south. 7:15 P.M.
2	April 2	28-14-1-NW	Hen. Eosin dye observed. Bird at edge of swale in marsh grass, 100 yards from release point. Approached to within 1 foot before it flushed. Flew SE to field and then ran into marsh. It was a fair flyer. 7:16 P.M.
3	April 2	28-14-1-NW	Hen. Eosin dye observed. Bird was along edge of swale, 100 yards from release point. Ran among grass and brush. Approached to within 5 feet before it moved. It did not attempt to fly. 7:18 P.M.
4	April 2	28-14-2-SE	Hen included in a group of 3 hens and 2 cocks which were observed in the brush along the edge of the marsh. None of the birds attempted to fly. They walked around and stopped now and then. Eosin dye observed on all of them. Approached to within 10 feet of them.
5	April 2	28-14-2-SE	Hen
6	April 2	28-14-2-SE	Hen
7	April 2	28-14-2-SE	Cock
8	April 2	28-14-2-SE	Cock
9	April 2	28-14-2-SE	Hen, possibly wild, flushed in oak-brush thicket. Flew SE very fast and well. No dye observed. Approached within 10 yards before flushing.

Number	Date	Location	Remarks
10	April 3	28-14-2-SE	Hen. Eosin dye observed. Found along edge of swale in brush. It made no attempt to fly. Approached to within 10 feet. Ran towards marsh to the south. 11:45 A.M.
11	April 3	28-14-2-SW	Hen. Eosin dye observed. Bird was in marsh grass. Approached to within 25 yards. Flew in a SW direction. 11:50 A.M.
12	April 3	28-14-2-SW	Hen. Eosin dye observed. Found in brush at fringe of marsh. It did not fly. Ran west into brush. Approached to within 10 feet. Was 250 yards from the release point. 11:55 A.M.
13	April 3	28-14-2-SW	Hen. Bird was 125 yards from release point in brush at edge of marsh. Ran in small circle and tried to hide. Approached to within 10 feet. It did not attempt to fly. Was accompanied by cock. Eosin dye observed on both. 12:00 A.M.
14	April 3	28-14-2-SW	Cock. Bird was 125 yards from release point in brush at edge of marsh. Ran in small circle and tried to hide. Approached to within 10 feet. It did not attempt to fly. Was accompanied by hen. Eosin dye observed on both. 12:00 A.M.
15	April 3	28-14-2-SW	Hen. Found 150 yards from release point. Approached to within 35 yards. Eosin dye observed. Flushed, and flew well. 12:05 P.M.
16	April 3	28-11-1-SW	White cock. Seen on Dexter Trail at 7:00 A.M. Flushed and flew ½ mile SE into grain field.
17	April 3	33-2-2-NE	White cock. Found 250 yards from release point in south side of marsh. Approached to within 15 yards. Threw sticks and ran at him in an attempt to make him fly. Could not be made to flush. He walked along a short distance ahead of observer. This bird can fly well as he flew about a quarter of a mile earlier in the day when flushed. 12:15 P.M.

Number	Date	Location	Remarks
18	April 7	28-14-2-NE	Hen. Found 50 yards from release area. Eosin dye observed. Flushed from cropland stubble near marsh edge where released birds roosted April 2.
19	April 7	28-14-2-NE	Hen. Found 50 yards from release area. Eosin dye observed. Flushed from cropland stubble near marsh edge where released birds roosted April 2.

Summary of mortalities, possible mortalities, old mortalities and observations of live released birds in the vicinity of Dexter Trail release site #3.

Mortalities - 3 (1 male - 2 females)

Possible mortalities - none

Old mortalities - 4 (hens)

Observations of live released birds - 19 (5 males - including 2 of white cock - 14 females)

Observations of Released Birds and Mortalities

Mortalities - Area #4 - Potter Road

Number	Date	Location	Description
1	April 3	5-2-2-SE	Hen #118912. Green dye observed. Entrails had been picked out. Bones picked fairly clean. Skeletal structure fairly intact. A possible owl or hawk predation, was found at edge of marsh near release point.
2	April 5	5-1-1-SW	Cock. Green dye observed. Wings and skeletal basket all that remained. Bones were picked clean. Predator or scavenger, a bird. Found along fence line bordering pasture and state property.

Number	Date	Location	Description
3	April 5	32-16-4-SW	Hen. Observed green dyed feathers at junction of wood edge and field. Feathers distributed in large patches over an area of 20 square feet. No solid parts nor bands were found. Blood and flesh smeared on grass and feathers.
4	April 5	32-15-4-SW	Hen. Green dye observed. Found carcass minus head, legs and one wing; searched area, no conclusions as to the type of predation. Found in sedge at marsh edge.
5	May 10	5-1-2-SE	Hen. Green dye observed. A great many feathers and tibia lying under a clump of shrubs. Kill too old to determine cause of death.

Possible Mortalities - Potter Road Area #4

1	-------	5-1-1-SW	Green dye on feathers observed. One leg observed, could have been part of mortality number two, as feathers were those of a cock.
2	-------	32-16-2-SW	Feathers, green dyed, from a possible kill. A positive kill, if feathers were not from another mortality.

Old Mortalities

Number	Date	Approximate Location	Remarks
1	May 1	5-1-2-NE	Remains weathered, grass on top of kill. Remains scattered.
2	May 1	5-1-2-NW	On side hill in grass, remains scattered. Band #110968.
3		4-2-4	Found by a Game Division observer. Band #77950. Listed as a released mortality of this year. Band number does not agree (old kill found on Seven Gables #77949 same release).

Number	Date	Approximate Location	Remarks
4		5-1-2	Hen. Feathers. Last year's kill.
5		5-1-2	Hen. Feathers. Last year's kill.
6		5-1-2	Hen. Feathers. Last year's kill.
7		5-1-2	Hen. Feathers. Last year's kill.
8		5-1-2	Hen. Feathers. Last year's kill.

Observations of Released Pheasants

Potter Road Release Area #4

Number	Date	Location	Description
4		Area #4	Hens. Definitely released birds. No description or exact locations of observations available.
2		Area #4	Same as above.

Summary of mortalities, possible mortalities, old mortalities and observations of released birds on area #4, Potter Road.

Mortalities - 5 (1 cock - 4 hens)

Possible mortalities - 2

Old mortalities - 8 (7 hens - 1 unknown)

Observations - 4 hens - 2 cocks

TABLE 4

PHEASANTS RELEASED ON THE DANSVILLE AREA
AUGUST 31, 1949

Game Farm Males Tag Numbers		Wild Tag Numbers
	Release #1 IN-IE Sec. 4	
128031-128040 Yellow 11-20		128011-128020
	Release #2 IN-IE Sec. 3	
128081-128090 Yellow 60-71		127991-128000
	Release #3 TIN-RIE Sec. 3	
128091-128100		128001-128010
	Release #4 TIN-RIE Sec. 3	
128041-128050 Yellow 21-30		127961-127970
	Release #5 TIN-RIE Sec. 3	
128111-128120 Yellow 91-100		127981-127990
	Release #6 T2N-RIE Sec. 33	
128071-128080 Yellow 51-60		127971-127980
	Release #7 T2N-RIE Sec. 33	
128061-128070 Yellow 11-50		127951-127960

Game Farm Males Tag Numbers	Wild Tag Numbers
Release #8 **T-2N-R-IE Sec. 33**	
128051-128060 Yellow 31-40	127941-127950
Release #9 **T2N-RIE Sec. 33**	
128021-128030 Yellow 1-10	127931-127940
Release #10 **T2N-R-IE Sec. 33**	
128101-128110 Yellow 81-90	127921-127930

TABLE 5

BAND RETURNS OF PHEASANTS RELEASED
AUGUST 31, 1949

How Recovered	Game Farm Males	How Recovered	Wild Males
	Site #1		
Shot	128038	Shot	128018
Shot	128032	Found dead	128020
Shot	128034	Shot	128012
		Found dead	128019
	Site #2		
Shot	128082	Shot	128000
Shot	128083	Shot	127994
		Shot	127998
	Site #3		
Shot	128097	Shot	128001
	Site #4		
Shot	128046	Shot	127963
Shot	128044	Shot	127968
		Shot	127969
	Site #5		
Shot	128118	Shot	127986
Shot	128117		
	Site #6		
Shot	128071	Shot	127973
		Shot	127978
		Shot	127974
	Site #7		
Shot	128065	Shot	127955
Shot	128069		
Shot	128070		

How Recovered	Game Farm Males	How Recovered	Wild Males
	Site #8		
Shot	128060	Shot	127927
Shot	128054	Shot	127921
	Site #9		
Shot	128021	Shot	127937
Shot	128024	Shot	127932
	Site #10		
	0	Shot	127927
		Shot	127921
TOTAL	18		22

TABLE 6

SOME HIGHER PLANTS COMMON
TO THE DANSVILLE AREA

The Shrubs

Listed in estimated approximate order of prevalence

Species	Where Found	Food Value Percent of Diet
Cornus stolonifera (Red osier dogwood)	Swamp	1/2 to 2%
Cornus racemosa (Grey dogwood)	Woods	1/2 to 2%
Salix candida (Honey willow)	Swamp	
Salix nigra (Black willow)	Swamp	
Salix humilis (Small pussy willow)	Marsh edge	
Salix sp. (Unidentified)	Swamp	
Crataegus sp. (Hawthorn)	Woods edge	1/2 to 2%
Rhus Toxicodendron (Poison ivy)	Woods	1/2 to 2%
Sambucus canadensis (American elderberry)	Road edge and woods	2 to 5%
Spiraea alba (Meadow sweet)	Woods	
Rhus vernix (Poison sumac)	Lowland woods	1/2 to 2%
Zanthoxylum americanum (Prickly ash)	Woods edge	
Vitis sp. (Wild grape)	Woods edge and fence row	2 to 5%
Rubus idaeus (Raspberry, Red)	Woods edge	10 to 25%
Rubus occidentalis (Raspberry, Black)	Woods	10 to 25%
Rubus sp. (Blackberry)	Woods and field	10 to 25%
Prunus serotina (Black cherry)	Woods and field	1/2 to 2%

Species	Where Found	Food Value Percent of Diet
Pyrus malus (Apple)	Old orchards and reproduction fields	5 to 10%
Ribes cynosbati (Gooseberry)	Woods	
Prunus virginiana (Choke cherry)	Fields	2 to 5%
Spiraea latifolia (Broad-leaved meadow sweet)	Fields	
Cephalanthus occidentalis (Button-bush)	Lowland woods	1/2 to 2%
Viburnun acerifolium (Arrow-wood)	Woods	1/2 to 2%
Hypericum spathulatum (Shrubby St. John's Wort)	Woods edge	
Chamaedaphne calyculata (Leather-leaf)	Marsh	
Gaylussacia baccata (Huckleberry)	Low places	
Hamamelis virginiana (Witch-hazel)	Woods	
Lonicera sp. (Honeysuckle)	Woods	
Amelanchier canadensis (Juneberry)	Woods	
Rosa carolina (Carolina rose)	Marsh edge	1/2 to 2%
Alnus rugosa (Speckled alder)	Woods	
Smilax sp. (Greenbrier)	Woods	1/2 to 2%
Parthenocissus quinquefolia (Virginia Creeper)	Field	
Viburnum lentago (Nannyberry)	Marsh edge	1/2 to 2%
Cornus florida (Flowering dogwood)	Woods	1/2 to 2%
The Herbs		
Hepatica acutiloba (Hepatica)	Woods	
Sanguinaria canadensis (Bloodroot)	Woods	

Species	Where Found	Food Value Percent of Diet
Erythronium americanum (Dog's-tooth violet)	Woods	
Dentaria laciniata (Toothwort)	Woods	
Claytonia virginica (Spring-Beauty)	Woods	
Capsella Bursa-pastoris (Shepherd's-purse)	Fields	
Dicentra Cucullaria (Dutchman's-breeches)	Woods	
Geranium maculatum (Spotted Cranesbill)	Woods	
Viola canadensis (Canada Violet)	Field edge, woods	
Caulophyllum thalictroides (Blue cohosh)	Woods	
Anemonella thalictroides (Rue-Anemone)	Woods	
Taraxacum officinale (Dandelion)	Fields	Possibly
Anemone quinquefolia (Wood Anemone)	Woods	
Solanum Dulcamara (Bittersweet Nightshade)	Woods	1/2 to 2%
Thalictrum sp. (Meadow-Rue)	Fields	
Occur Frequently		
Podophyllum peltatum (May-apple)	Woods	
Trillium flexipes (Trillium)	Woods	
Viola striata (Cream Violet)	Woods	
Oxalis grandis (Wood-Sorrel)	Woods	
Viola pubescens (Downy Yellow Violet)	Woods	
Actaea alba (White Baneberry)	Woods	
Caltha palustris (Marsh-Marigold)	Swamps	1/2 to 2%
Trifolium repens (White Clover)	Woods edge	1/2 to 2%

Species	Where Found	Food Value Percent of Diet
Trifolium procumbens (Hop-Clover)	Woods edge	1/2 to 2%
Symplocarpus foetidus (Skunk Cabbage)	Woods and swamp	2 to 5%
Uvularia grandiflora (Bellwort)	Woods	
Smilacina trifolia (False Solomon's-seal)	Woods edge	
Polygonatum biflorium (Solomon's-seal)	Woods	
Rumex Acetosella (Sheep-Sorrel)	Fields	1/2 to 2%
Rumex Crispus (Yellow Dock)	Fields	1/2 to 2%
Cichorium Intybus (Chicory)	Fields	
Lychnis alba (White Campion)	Woods	
Ranunculus septentrionalis (Swamp Buttercup)	Woods	1/2 to 2%
Lepidium densiflorum (Pepper grass)	Woods edge	
Brassica kaber (Mustard)	Woods edge	2 to 5%
Barbarea vulgaris (Yellow Rocket)	Woods edge	
Fragaria virginiana (Wild Strawberry)	Woods edge and field	2 to 5%
Melilotus alba (Sweet Clover)	Woods	1/2 to 2%
Sanicula marilandica (Black Snakeroot)	Woods	
Osmorhiza Claytonia (Sweet Cicely)	Woods	
Daucus carota (Wild Carrot)	Woods edge and field	1/2 to 2%
Gaultheria procumbens (Wintergreen)	Woods	
Asclepias syriaca (Milkweed)	Woods edge and field	
Asclepias tuberosa (Butterfly-weed)	Field	

Species	Where Found	Food Value Percent of Diet
Hdyrophylum appendiculatum (Waterleaf)	Woods	
Rudbeckia hirta (Coneflower)	Woods edge	
Galium sp. (Bedstraw)	Woods edge	
Achillea Millefolium (Common Yarrow)	Fields	
Erigeron philadelphicus (Fleabane)	Woods edge	
Erigeron canadensis (Hogweed)	Fields	
Verbascum thapsus (Mullein)	Woods edge and fields	
Solidago sp. (Goldenrod)	Field and woods edge	
Polygonum aviculare (Knotweed)	Fields	2 to 5%
Polygonum convolvulus (Black Bindweed)	Fields	2 to 5%
Convolvulus arvensis (Field Bindweed)	Fields	1/2 to 2%
Boehmeria sp. (False Nettle)	Woods	
Parietaria sp. (Pellitory)	Woods	
Impatiens capensis (Jewelweed)	Field and woods edge	1/2 to 2%
Chenopodium album (Lambs quarters)	Fields	1/2 to 2%
Helianthus tuberosus (Jerusalem Artichoke)	Woods	2 to 5%
Helianthus sp. (Sunflower)	Field	2 to 5%
Agrostemma Githago (Corn-Cockle)	Fields	
Stellaria longifolia (Chickweed)	Woods	
Lepidium virginicum (Poor-Man's Pepper)	Fields	
Cirsium pumilum (Bull Thistle)	Woods edge	

Species	Where Found	Food Value Percent of Diet
Cirsium arvense (Canada Thistle)	Woods edge	
Silene Cucubalus (Bladder Campion)	Fields	
Monarda fistulosa (Wild Bergomot)	Fields	
Arctium minus (Common Burdock)	Woods edge	
Medicago lupulina (Black Medick)	Fields	
Ambrosia trifida (Great Ragweed)	Woods edge	5 to 10%
Ambrosia elatior (Ragweed)	Fields	5 to 10%
Pyrola sp. (Wintergreen)	Woods	
Lactuca canadensis (Lettuce "Milkweed")	Woods	1/2 to 2%
Vicia sp. (Vetch)	Fields	1/2 to 2%
Malva rotundifolia (Round-leaved Mallow)	Fields	
Mentha sp. (Mint)	Field edge	
Oenotherea sp. (Evening-Prinrose)	Woods	
Portulaca oleracea (Purslane)	Fields	
Vernonia altissima (Tall Ironweed)	Marsh edge	
Euphorbia sp. (Spurge)	Woods	
Apios sp. (Wild Bean)	Field	
Dipsacus sylvestris (Wild Teasel)	Woods and fields	
Iris versicolor (Blue Flag)	Woods	
Verbascum blattaria (Moth Mullein)	Fields	
Saponaria officinalis (Bouncing-bet)	Woods edge	
Lupinus perennis (Wild Lupine)	Fields	
Alisma triviale (Water-plantain)	Swamp	

Species	Where Found	Food Value Percent of Diet
Plantago rugelii (Plantain)	Building site	
Waldsteinia fragarioides (Barren Strawberry)	Fields	
Verbena hastata (Blue Vervain)	Swamp	1/2 to 2%
Plantago lanceolata (Ribgrass)	Old barn yard	
Lobelia Cardinalis (Cardinal Lobelia)	Woods	
Elodea canadensis (Water-thyme)	Lakes edge	
Sagittaria sp. (Arrowhead)	Lakes edge	
Lemna minor (Duckweed)	Lakes edge	
Nymphaea sp. (Water-lily)	Lakes	
	Grasses	
Agrostis alba (Red top Bentgrass)	Woods edge	
Bromus sp. (Brome-Grass)	Woods edge	1/2 to 2%
Avena fatua (Wild oat)	Woods edge	5 to 10%
Setaria viridis (Green Foxtail)	Fields	1/2 to 2%
Setaria glauca (Pigeon-grass)	Fields	1/2 to 2%
Agropyron repens (Quack Grass)	Fields	1/2 to 2%
Poa pratensis (June grass)	Woods edge	1/2 to 2%
Phleum pratense (Common Timothy)	Woods edge	
Berteroa incana (Hoary alyssum)	Woods edge	
Bromus tectorum (Brome grass)	Woods edge	1/2 to 2%
Andropogon sp. (Beardgrass)	Woods edge	
Calamagrostis sp. (Reed-Bentgrass)	Woods edge	

Species	Where Found	Food Value Percent of Diet
Digitaria Ischaemum (Crab-Grass)	Woods edge	
Echinochloa crusgalli (Barnyard-Grass)	Woods edge	
Panicum capillare (Old-witch grass)	Woods edge	
Elymus virginicus (Terrell Grass)	Swamp	1/2 to 2%
Sedges		
Carex tribuloides	Swamp	1/2 to 2%
Carex sp.	Swamp	1/2 to 2%
Scirpus sp. (Bullrush)	Swamp	1/2 to 2%
Carex pensylvanica (Pennsylvania sedge)	Swamp	1/2 to 2%
Rushes		
Juncus effusus (Soft Rush)	Swamp	
Cat-tail		
Typha latifolia (Cat-tail Flag)		

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