ABSTRACT

A 2,322-acre enclosure which contains an estimated deer per 5 acres, is used for deer ecology studies. During the past 5 years, 258 fawns have been captured, marked, and released; 229 are known to have survived to 2 months of age. Observations have revealed data on fawn mortality by age at time of capture, by sex, by year, by multiple birth, and abnormalities. Methods used are described for capture of fawns. Causes of fawn mortality cannot always be identified, but survival of marked individuals is known.

PROGRESS REPORT ON CAROLINA SANDHILLS MOURNING DOVE STUDIES [1]

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ABSTRACT

The objectives, methods, and study areas of the Carolina Sandhills mourning dove investigation are described as they apply to present and future research. Indexes to mourning dove nesting densities are gained by means of 25 call-count routes in a 10-county intensive study area and 45 call-count routes in a 33-county extensive study area. These indexes will be correlated with habitat characteristics to determine specific qualities of desirable dove nesting habitat and to gain insight into possible effects of widespread changes in land-use and agricultural practices on dove nesting populations.

The 25 intensive-study-area routes were each run three times per year. In addition, several were covered weekly throughout each summer. Extensive-study-area routes were run only once per year. The average number of doves heard calling per intensive-study-area route was 47.39 in 1968 and 48.14 in 1969. Averages for the extensive study area were 38.80 in 1968 and 37.49 in 1969. Other call-count survey results are presented and discussed, including doves heard, rates of calling, and doves seen.

Opening-day dove kill and hunter success on two managed hunts within the intensive study area were sampled. For these two hunts, average bag sizes were 6.15 and 5.61; limit bags (12) were obtained by 18.5 percent and 9.2 percent of the hunters; and age ratios in the kill were 4.9 and 6.6 immatures per adult.

Project dove trapping and banding accomplishments are discussed.

INTRODUCTION

The mourning dove is the most important game bird species in North America from the standpoint of hunter harvest. The most recent estimate of nationwide mourning dove harvest is 41.9 million birds for 1965 (Bureau of Sport Fisheries and Wildlife, 1967). Previous estimates were 11 million in 1942, 15 million in 1949, and 19 million in 1955. These figures indicate a great increase in harvest in recent years, but since no sampling frame exists with which to reliably sample mourning dove hunters, the exact magnitude of the increase is somewhat uncertain. It is unfortunate that we do not have more reliable harvest estimates; the species has not received management attention commensurate with its popularity as a game bird. Mourning dove research has not kept pace with the demand for utilization of the dove resource.

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Recognizing this situation, cooperative efforts were begun by the Southeastern Association of Game and Fish Commissioners, the International Association of Game, Fish and Conservation Commissioners, the Wildlife Management Institute, and others, which led to the inauguration, on July 1, 1967, of an accelerated research program on mourning doves and other migratory upland game birds. Mourning dove projects in this accelerated program include the present study—a long-term Bureau investigation—and nine State contract projects. Most contracts are with nonhunting States in an attempt to bring their programs for evaluating dove populations up to the levels found in hunting States.

This paper reports on my field work for the Bureau's mourning dove study, which began under the accelerated research program in April, 1968.

OBJECTIVES

The main objective of this study is to relate mourning dove populations to habitat characteristics. Of particular interest are factors affecting dove distribution and population levels. It is hoped that the study will help provide a means of predicting the effects of changes in land-use patterns on mourning dove populations. Since this paper is a progress report, it does not cover all of the objectives; however, they are listed because of their importance to the overall study.

(1) To obtain indexes to the density and breeding activity of mourning doves in the study area, and relate these to differences in habitat.

(2) To determine the extent to which vegetation, observer differences and other factors influence the results of mourning dove call-count routes.

(3) To estimate mourning dove production and harvest in the study area.

(4) To determine annual mortality rates and harvest rates by age and sex for doves in the study area.

(5) To determine mourning dove mobility within the study area and the extent of long-range movement.

(6) To evaluate trapping techniques presently used for mourning doves.

STUDY AREAS

The study is centered around the Carolina Sandhills National Wildlife Refuge, near McBee, South Carolina. Mourning dove breeding densities in this general area are among the highest in the Nation as measured by the call-count survey (Ruos and Tomlinson, 1968, and Ruos and MacDonald, 1968). Two study areas are defined, based on the intensity with which the mourning dove breeding populations are sampled: (1) a 10-county, intensive study area including Chesterfield, Darlington, Kershaw, Lancaster, Lee, and Marlboro counties in South Carolina, and Anson, Richmond, Scotland, and Union counties in North Carolina; and (2) an adjacent 33-county, extensive study area (18 in South Carolina and 15 in North Carolina). County lines are used for study area boundaries since Project results will be compared with existing habitat and land-use surveys developed by agricultural and forestry agencies which are reported almost exclusively on a county basis. Together, the intensive and extensive study areas include a major portion of the Upper Coastal Plain and Piedmont Uplands physiographic regions of the Carolinas (terminology after Fenneman, 1938).

METHODS

This study involves correlating breeding populations with habitat characteristics in order to understand mourning dove populations. Principal field efforts of the project leader and four summer assistants are limited to the intensive study area. Data for the extensive study area are almost entirely from the efforts of State and Bureau cooperators.

Call-Count Routes

Call counts along randomly selected routes throughout the intensive and extensive study areas serve as indexes to mourning dove breeding population levels. Sampling intensity is greatest in the intensive study area, with 25 routes in the 10 counties. The 33-county extensive study area contains 45 routes, including 20 national survey routes. Thirty-five routes were used in the extensive study area in 1968, and 10 more were added in 1969 after preliminary examination of 1968 data indicated a need for increased sampling.

Project call-count routes are run in a similar manner to national survey routes. Briefly, a call count begins 30 minutes before sunrise and continues for 2 hours. The observer listens for 3 minutes at each of 20 stations. Listening stations are spaced at 1-mile intervals, and 3 minutes are allotted for driving between stations. Data collected include the number of doves heard calling and the number of calls heard at each listening station. The number of doves seen at each station and while driving between stations is recorded. Information on weather conditions and other factors which may affect dove calling behavior or the observer's hearing ability are also recorded.

Intensive-study-area routes are covered three times per season, in contrast to national survey routes which are run once between May 20 and June 10. Listening stations on all intensive-study-area routes are permanently marked to assure comparable sampling during successive coverages.

All intensive-study-area routes are run twice between May 12 and June 18—once by the project leader and once by the project assistants. This survey period was chosen to coincide as nearly as possible with the national survey period and still provide adequate time for coverage of all routes by one observer. A third coverage each season, during early August, is made by the project leader and his assistants; each runs five routes. Several intensive-study-area routes are run weekly throughout the summer to provide indexes to fluctuations in breeding activity. In addition, one route is run weekly throughout most of the year to determine when measurable calling occurs. Weekly routes are covered by the same observers on successive weeks.

Extensive-study-area routes are run only once per season, during the May 20-June 10 national survey period.

Call-count routes also serve as habitat study transects, so that comparisons of breeding activity with habitat characteristics can be made.

Trapping and Banding

Efforts are made to band as many mourning doves as possible in the intensive study area. Doves are caught in bait traps, using methods generally described by Reeves, Geis, and Kniffin (1968).

Trapping took place at 22 sites in 1968, but in 1969, only the 11 most productive sites of the previous year were used.

Although there is presently a strong nationwide effort to band mourning doves, trapping methods have not been carefully studied. Therefore, a part of the trapping program in this study is to determine which trapping techniques are most productive. Experimental trapping was done on the Carolina Sandhills National Wildlife Refuge for 6 weeks in 1968 and for 14 weeks in 1969. Similar trappings conducted for 3 weeks near Seymour, Indiana, in 1969, will permit a comparison of our results with results from another area.

Wing-Collection Surveys

Wings were collected from doves bagged by hunters on the opening day of the dove season at two managed hunts in 1968. On the Sandhills (State) Wildlife Management Area in North Carolina, hunters were required to pass through a checking station, and a sample of

wings was taken at check-out time. On the Sand Hills State Forest in South Carolina, where no check-out was required, the sample was obtained from hunters contacted in the field.

All wings were aged by Project personnel according to standard techniques (Wight, Tomlinson, and Blankenship, 1967).

RESULTS

Intensive-Study-Area Call Counts

Current nationwide trends in mourning dove breeding populations are measured using the technique developed by Foote and Peters (1952), with the latest results being reported by Ruos and MacDonald (1968). The same technique was used to measure mourning dove populations in this study. The average number of doves heard calling per route in 1968 was 47.39 on May-June runs and 47.38 on August re-runs. In 1969, averages of 52.94 and 38.54 doves were heard calling on May-June runs and August re-runs, respectively (table 1). Tests of significance (t tests) indicated no significant differences in numbers of doves heard between May-June runs and August re-runs in 1968 or between years. In 1969, the average number of doves heard calling per route was lower on August re-runs than on May-June runs ($P=0.05$).

An average rate of calling for doves on each route was calculated by dividing the total number of calls heard by the number of doves heard calling. Recent studies have demonstrated that mated and unmated males vary widely in rates of calling, depending on the stage of the nesting cycle (Frankel and Baskett, 1961; Jackson and Baskett, 1964; and Mackey, 1965). The average rate of calling for doves in 1968 was 5.67 on May-June runs and 5.40 on August re-runs. In 1969, average rates of calling were 5.60 and 4.38 for doves heard on May-June runs and August re-runs, respectively. There were no significant differences in average rates of calling between runs in 1968 or for May-June runs between years. In 1969, the rate of calling on initial runs was significantly higher than re-runs, and the August re-run rate was lower than either initial run ($P=0.05$).

Doves seen are less acceptable as an index to breeding density than doves heard (Peters, 1952), but continue to be recorded in the nationwide mourning dove breeding population survey and are, therefore, recorded in the present study. The average number of doves seen per route in 1968 was 24.83 on May-June runs and 34.17 on August re-runs. In 1969, averages of 24.29 and 45.58 doves were seen on May-June runs and August re-runs, respectively. There were no significant differences in average numbers of doves seen within or between years ($P=0.05$).

Weekly call counts on a single route which was run several times by the same observer offered an opportunity to examine calling variability. Although data on rates of calling and doves seen are also available for weekly routes, they will not be discussed in this paper because of time liimtations. Numbers of doves heard weekly on three intensive-study-area routes during 1968 are shown in figure 1. A similar pattern existed in 1969.

The relative variability of doves heard on all intensive-study-area routes—each run once—was compared to the relative varability of doves heard on weekly routes—each run several times. This was done by comparing the standard errors divided by the means in each case. For all intensive-study-area routes, standard errors were between 6.30 percent and 7.53 percent of the respective means. For the three weekly routes shown in figure 1, percentages were 6.49, 8.10, and 10.19. This suggests that variability between runs on each of these three routes was as great as between all routes in the intensive study area.

One weekly route was run over an extended period. Monthly averages show a considerable reduction in the numbers of doves heard calling

from September through January, with no calling activity in October and November (fig. 2).

It seems unlikely that observer differences played a significant role in accounting for variability in intensive-study-area call counts, since results obtained on routes run at the same time by several different observers were consistently similar (table 2). Observer consistency can also be demonstrated by comparing the relative veriability of August re-runs—involving five observers—with the relative variability of initial runs—involving one observer in 1968 and two observers in 1969. The standard errors of August re-runs were only slightly higher percentages of their respective means: 1968—7.53 percent as opposed to 6.30 percent; 1969—7.14 percent as opposed to 6.58 percent. Perhaps more important than hearing ability, which is often cited as contributing to variation between observers, are proper training and sufficient experience.

Extensive-Study-Area Call Counts

During both 1968 and 1969, the single May 20-June 10 coverage of extensive-study-area, call-count routes was completed by State and Federal cooperators not under direct Project supervision. More observers participated in extensive-study-area coverage than in intensive-study-area coverage.

The average number of doves heard calling per route was 38.80 on the 35 routes used in 1968. This was lower, though not significantly, than the mean for the intensive study area. Including the 10 routes added in 1969, the average number of doves heard per extensive-study-area route was 37.49. This was significantly lower than the average number of doves heard per intensive-study-area route ($P=0.05$).

Average numbers of doves seen per route in the extensive study area (table 1) were not significantly different between years. There were no significant differences between intensive and extensive study areas in average numbers of doves seen per route ($P=0.05$).

For rates of calling, no significant differences existed between years for the extensive study area or between intensive and extensive study areas ($P=0.05$).

Trapping and Banding

During the preseason banding periods (June through August) of 1968 and 1969, Project personnel banded more than 7,500 doves in the intensive study area. Data from approximately 2,500 recaptures of these birds are also available for analysis. In addition to age and sex, molt data were recorded for all doves handled by Project personnel.

To date, 163 direct recoveries of doves banded by Project personnel in 1968 have been reported. Recovery records for birds banded in 1969 are not yet complete. The recovery rate was 0.0459 for birds banded during the calendar year of hatching (designated as HY birds), and 0.0410 for birds banded after the calendar year of hatching (designated as AHY birds). An immature adult relative recovery rate of 1.121 was calculated from these data. However, this must be regarded as a preliminary estimate because only a relatively small number of AHY recoveries was available.

Concerning recovery locations, 68.4 percent of the AHY recoveries and 72.1 percent of the HY recoveries were not from the 10-minute geographical grid of banding. All except four recoveries were from the Carolinas. One AHY and two HY's were recovered in Florida and one HY was recovered in Georgia.

Later reports will give a more complete analysis of banding and recovery data, and will include information on mortality and survival rates, local and long-range movements, and indirect population estimates.

A preliminary analysis of data from the three trap evaluation studies indicates considerable differences in capture success for the several types

of traps tested. This suggests that dove banding can be more successful and economical by using the most efficient trap. The results will be reported more fully at a later date.

Wing-Collection Surveys

Opening-day dove hunts in 1968 attracted 884 hunters to the Sandhills (State) Wildlife Management Area in North Carolina and 770 hunters to the Sand Hills State forest in South Carolina. On the Sand hills Wildlife Management Area, where a better sampling system was possible, 158 hunters' bags were checked. On the Sand Hills State Forest, 112 bags were sampled, of which only 65 were completed hunts. Data in the following paragraph are from the Sandhills Wildlife Management Area unless otherwise indicated.

Average bag sizes on the two hunts were 5.61 for the Sandhills Wildlife Management Area and 6.15 for the Sand Hills State Forest. This includes the 2.5 percent of hunters who obtained no doves. The most common bag was one, which was obtained by 21.5 percent of the hunters. Limits (bag size 12) were obtained by 18.5 percent of the Sandhills Wildlife Management Area hunters and 9.2 percent of the Sand Hills State Forest hunters. On the Sandhills Wildlife Management Area, limit bags accounted for 42.1 percent of the doves killed. Fifty-six percent of the hunters killed fewer than five doves, and accounted for 21 percent of the kill. Unadjusted age ratios in the opening-day kill were 6.6 immatures per adult on the Sandhills Wildlife Management Area and 4.9 immatures per adult on the Sand Hills State Forest. Doves with completed molts were tallied as immatures.

Supporting Studies

Student assistants on the Carolina Sandhills Mourning Dove Research Project pursued supporting studies relating to the Project's overall objectives. Trap evaluation studies at the Refuge were carried out in this manner. Other supporting studies of particular merit were concerned with (1) variation in calling activity during the regular call-count survey period (½ hour before to 1½ hours after sunrise), (2) the types of perches used by cooing doves, and (3) the effects of various types of vegetation on the audibility of dove calls. Results of these studies will be included in later reports.

DISCUSSION

It is a fundamental rule of wildlife management that in order to have huntable game populations, we must have sufficient habitat of the proper types. There are numerous instances where local populations of nonmigratory species have virtually disappeared as a result of changes in land-use practices, and the decline in migratory waterfowl populations is thought to be directly related to the destruction of vital breeding habitat. It might be suggested, from comparisons of early-day mourning dove population estimates with today's best estimates, that the mourning dove may also be affected by changes in land-use patterns, despite its widespread breeding distribution. This may be especially true with respect to management unit populations or segments of these populations where changes in agricultural or forestry practices may involve a large portion of the available nesting habitat.

A recent article in *The Wall Street Journal* (Leger, 1967) described the present boom in pine production in the Southeast. Timber sales for pulpwood in the Southeast doubled between 1956 and 1967. Pulpwood is harvested in 90 percent of all southern counties—more than twice as many as 20 years ago. This is an apparently widespread land-use change which may affect dove populations. Although pine trees are considered by many biologists to be desirable dove nesting habitat, this is perhaps only true of mixed-age natural stands. An increase in large, single-age stands may cause dove nesting densities to drop, since doves appear to prefer nesting near some sort of edge (Hopkins and Odum,

1953). Other widespread changes which could affect dove populations are changes in the major cash crop over large areas, or changes in the use of herbicides, which could affect the abundance and seed production of weeds.

Call Counts

Results of 2 years' call counts in the study areas generally indicated little change in dove population levels between years. Differences between May-June and August results in 1969 are possibly due to very wet weather during the summer.

Use of the nationwide call-count survey to indicate changes in levels of the mourning dove breeding populations is based on the assumption that mourning dove calling is indicative of breeding activity. There is general agreement that this assumption is valid. However, it may be possible to improve the precision of the present survey, and thereby enhance its usefulness. Improvements could include (1) further delineation of the survey period—in both date and time of day—to measure calling during the most consistent period, and (2) correcting call-count results for audibility differences caused by habitat or weather factors. Providing cooperators with further understanding of the importance of the call-count survey and clarification of what is expected of them could also result in considerable improvement of the data.

A major analysis of nationwide call-count data is currently being done by the Migratory Bird Population Station. Information on call-counts from the Sandhills Study will be considered in this analysis and will not be discussed further here.

Production

Age ratios in the kill, when corrected for differential vulnerability between age groups, may be used as estimates of production. The best data for determining age composition of the harvest in the study area can probably be found in the cooperative, dove wing-collection survey; however, it has not yet been possible to separate these data according to intensive and extensive study area units. An example of how estimates of productivity can be determined is illustrated by use of managed hunt data and Project band recovery rates. Actually, both should relate to the same period of time. Unadjusted age ratios in opening-day kill on the managed hunts were 4.9 and 6.6 immatures per adult. Using the differential vulnerability figure obtained from Project bandings to correct these, and multiplying by two, the production is estimated to have been between 8.7 and 11.7 immatures per pair in 1968. These figures are considerably higher than previous estimates of mourning dove production (summarized by Lowe, 1956) and are undoubtedly inflated by concentration of immatures on the areas from which the age ratios were obtained. For several reasons, these figures are not acceptable estimates of production in the study area and are only given to illustrate how wing-collection age ratios and band recovery data may be used to estimate production.

CONCLUSIONS

The nature of this paper—that of a progress report rather than a final report—makes the drawing of conclusions somewhat premature. Results from the Carolina Sandhills mourning dove investigation will be reported periodically at future Southeastern Conferences, or published.

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TABLE 1. Average numbers of doves heard and calls per dove heard, and average numbers of doves seen, on intensive and extensive study area call count routes for 1968 and 1969 (standard errors in parentheses)

	Avg. No. of Doves Heard	Avg. No. of Calls per Dove Heard	Avg. No. of Doves Seen
Intensive Study Area*			
1968:			
Initial runs	49.00 (3.09)	5.49 (0.17)	25.83 (4.08)
Re-runs	45.79 (2.99)	5.84 (0.17)	23.83 (3.94)
August re-runs	47.38 (3.57)	5.40 (0.17)	34.17 (5.32)
1969:			
Initial runs	49.71 (3.27)	5.84 (0.17)	31.25 (10.51)
Re-runs	56.17 (4.13)	5.37 (0.10)	17.33 (2.81)
August re-runs	38.54 (2.75)	4.38 (0.17)	45.58 (17.37)
Extensive Study Area**			
1968	38.80 (4.83)	5.64 (0.44)	30.34 (5.17)
1969	37.49 (3.97)	5.53 (0.30)	24.36 (2.82)

* 24 routes used for intensive study area analysis.
** 35 routes used in extensive study area in 1968 and 45 in 1969.

TABLE 2. Examples of consistency in the numbers of doves heard calling by several observers running routes at the same times

	Doves heard according to observer number						
Date Observer	1	2	3	4	5	6	7
May 31, 1968	76	72					
July 23, 1968	65		67	67			
July 30, 1968	65	71	71				
June 6, 1969	81				75	75	
June 19, 1969			12				13
June 26, 1969			63	58			55

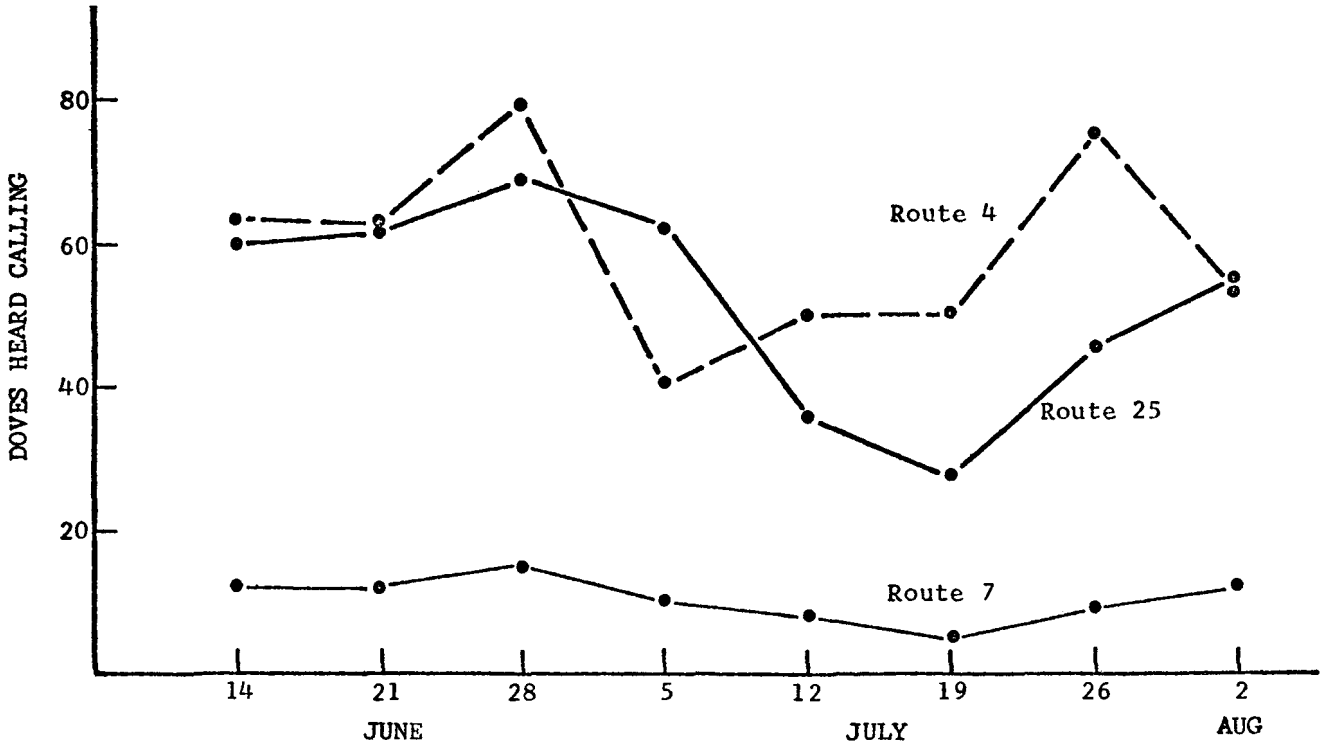

Figure 1. Numbers of doves heard calling each week on three call-count routes in 1968.

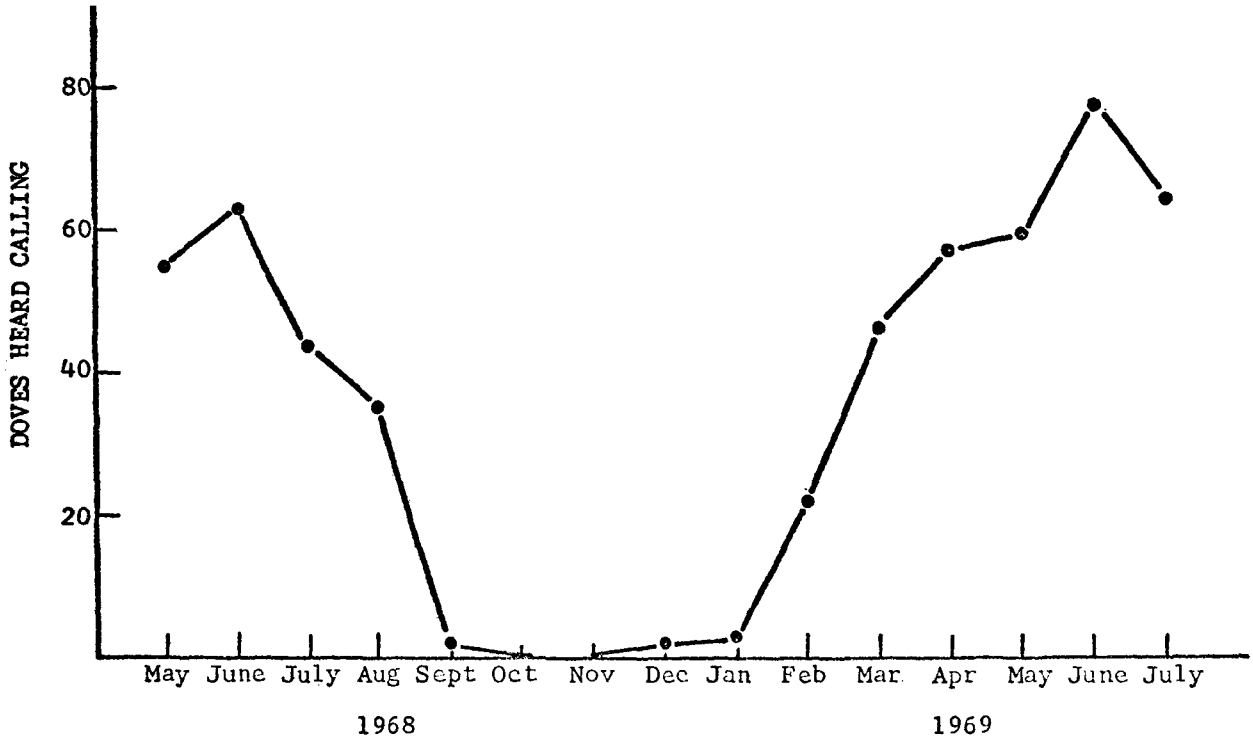

Figure 2. Monthly averages of doves heard calling on a selected weekly call-count route.