tion and to evaluate each brood line through to pure stock. A back cross of the persicus group is planned for the 1960-1961 season, at which time, with everything favorable, a release of pure birds may be made.

A shipment of 27 Japanese green pheasants, *P. versicolor,* were flown to Virginia from Tokyo, Japan, on April 23, 1959. This shipment was made up of nine cocks and 18 hens, and despite the late arrival reasonably good success was obtained in game farm breeding; a total of 69 young birds were produced. All of these will be held for brood stock for the coming season.

The purpose of this report is not to evaluate to any degree the success of this experiment, since the period covered is for only one breeding season. It is much too early to arrive at any conclusions as to its success. Results to date have been favorable, however, and there is a strong feeling that one of the groups might successfully be established in Virginia and perhaps in other sections of the Southeast.

AN EVALUATION OF FARM GAME MANAGEMENT PRACTICES IN KENTUCKY

By GERALD A. WUNZ
Kentucky Department of Fish and Wildlife Resources
Frankfort, Kentucky

INTRODUCTION

In the course of the farm game habitat improvement program in Kentucky, it became increasingly evident that anticipated results were not being attained (Durell, 1952). The ratio of established plantings to plants distributed was low and there was little indication the planting program was benefiting game populations or hunting success. With this skepticism in mind, an evaluation project was conceived with the major objective to determine the influence of food and cover patches upon game populations—particularly quail.

This paper presents a summary of the findings during the first eight years (1951 to 1959) of this intensive study of quail and rabbit population trends, prior to and following establishment of food and cover plantings on study areas located in Christian County in southwest Kentucky. Investigations of perennial exotic plantings were originally conducted on four areas, but as interest in annual mixture food plots increased, a fifth area, labeled M-3, was added in 1956, raising the total land area under study to 7,080 acres. Three of the areas, designated M-1, M-2 and M-3 were managed areas and two, labeled C-1 and C-2, were reserved as controls for their respective numbered managed areas. In addition, managed areas M-1 and M-2 were surrounded by ¼ mile wide buffer zones, called B-1 and B-2.

The areas are located in one of the best farming regions of the state. General farming is practiced, but the gradual trend in recent years has been from grain crops to beef cattle production. Topography is essentially flat to gently rolling semi-karst and surface streams are rare. Soils are of limestone derivation, deep and of good quality, with Pembroke (formerly Hagerstown) silt loam being a predominant type. This description generally fits all of the areas, except M-1 and B-1, where surface streams are common, portions are poorly drained, soils are inferior, erosion more severe and wasteland more abundant.

The major crops grown are corn, wheat and restricted acreages of tobacco. Korean lespedeza is the major hay crop, and much is also combined for seed. Korean-fescue mixtures predominate in the pastures. Little permanency exists in land use, due to the short rotational program.

Upland types—black oak, post oak and flowering dogwood predominate in the woodlots. Common field border species, some also occurring as woodland understory, are sassafras, hackberry, dwarf sumac, coralberry, blackberry, poison ivy and honeysuckle.

A few black locust thickets and osage orange hedgerows were also present. Common ragweed and Korean, abundant in recent fallow fields, were excluded in old fields by brush broomsedge and tall redtop. Korean, the major winter quail food in this region, is sufficiently established to be considered part of the native flora.

Areas of different natural quail habitat were purposely selected to conduct the study to determine differential effects of plantings. Hence, M-1 and its surrounding non-managed buffer zone were located in good quail habitat, M-3 in mediocre habitat, and M-2 and B-2 on very clean farmed land.

FOOD AND COVER PLANTINGS

The exotic perennial plant species were planted by state personnel on M-1 and M-2 in 1952 and 1953—some requiring complete replanting in 1954. Loss of a few plots by farming operations and flooding reduced the total available for study to 16 bicolor and japonica plots on each area, 7 sericea plots on M-1 and 2 on M-2, and 2.3 miles of multiflora rose fence on M-2. Rose was not required on M-1. Sixteen Virginia annual mixture food plots were sowed on M-3 in 1957 and again in 1958.

Bush lespedeza plots averaged better than 1/6 acre and annual plots 1/7 acre in size. Food plot densities were 1/34 acres on M-1, 1/72 acres on M-2 and 1/97 acres on M-3. Food plots were generally located adjacent to good natural cover, but this was not always possible on cover deficient M-2. Although only 0.2% to 0.8% of the total acreage on the managed areas were occupied by plantings, this management was much more intense than could be expected from the most cooperative of private landowners encountered on a statewide development program.

All plantings were fertilized, maintained and fenced. Much replanting was necessary due to severe drought and cattle damage following planting, but by 1956 good stands were finally attained in nearly all plantings. Cost of establishment and maintenance were $150/bush lespedeza plot, $57/sericea plot and $990/mile of rose fence. Hindsight reveals costs could have been halved with improved planting techniques and conducting only the very essential maintenance. Annual plots cost $28, including fencing, the first year and $11.50 thereafter, but for a six-year period would amount to $85/plot. It is apparent these expensive plantings must show significant game population gains to warrant practicability.

Shrub lespedeza seed production and availability, measured by catch boxes and litter samples, did not become significant until 1957, at an average plot age of five years. In 1957 and 1958 mean late winter availability, computed at 160 lbs. and at 300 lbs./acre, respectively, surpassed previous production and was much greater than that of any other native or domestic species sampled or known. Annual plot seed yields were high, but late winter availability was negligible. Essentially only two years data are available to determine influence of plantings on quail populations because previous shrub lespedeza seed availability was insignificant and annual plots were not planted prior to that time.

Game use of the perennial plantings increased with their maturity. Rabbits used rose most intensively. Quail utilization of bush lespedeza was negligible until 1957 and 1958, when over half of the plots were used. Preferred foods in the annuals demonstrated ability to lure quail in the fall, but use decreased from fall to winter while bush lespedeza use increased, reflecting relative availability. Quail food use of rose and sericea was negligible. Bush lespedezas and annuals achieved only minor importance in area quail food habits studies, but most craws were collected after or before the major use periods of each type planting.

In comparing use between existing and planted habitat types, quail and rabbits were found in the management plantings quite frequently in relation to the small acreage occupied. Quail appeared heavily reliant upon native brush and woods cover types, even on areas with scarcity, and rabbits upon herbaceous types.

QUAIL POPULATIONS

Study area quail populations were estimated by utilizing the repeated systematic and supplemental bird dog census data and other observations. The systematic census involved complete coverage of the areas three times prior to and again after the Nov. 20-Jan. 18 hunting season, followed by supplemental counts conducted on doubtful covey ranges. It was found estimated population trends did not deviate appreciably from those indicated by the means of the three systematic counts.

The total fall population of the areas in Figure 1 (except M-3 which was not included in the study until 1956) did not change appreciably until 1954, when a large increase occurred, followed by subsequent increases to a 1957 peak over three times as great as the lows occurring during the early years. This is believed representative of the trend occurring in the entire region of the study areas, during the same time period. The individual areas, included in Figure 2, also followed this similar trend, but with major increases and peaks sometimes occurring in different years. The management area M-1 and its surrounding buffer, B-1, followed similar trends, but M-2 populations have increased in late years, while those on B-2 decreased.

Winter quail populations tended to follow those of the previous fall, but not necessarily so in comparing year to year changes. Frequently an increasing fall population was followed by a decreasing winter population, or vice-versa. Winter populations often had little influence upon those of the following fall.

Weather conditions, particularly during reproduction, appeared the most important single factor influencing quail population trends. The low population of the early years is associated with severe summer droughts, increasing populations with near-normal weather and the 1958 decrease with the opposite weather extreme—cool and wet.

Quail generally increased despite detrimental land use practices, particularly clean-up campaigns, occurring on all areas except C-2, but some population trends could be correlated with land use. Habitat destruction was most detrimental on cover short M-2 and B-2.

The hunting data compared with fall to winter population drop indicated hunting was not excessive and had little influence upon area populations. Banding census, hunting and observational data showed area quail populations were also influenced considerably by ingress and egress. A negative correlation exists between decreasing skunk populations from a high level and increasing quail.

RABBIT POPULATIONS

Rabbit population indices were obtained from flushes recorded during the bird dog quail census and computed to observations per unit area and per unit time. Rabbits/100 acres was considered the criterion for determination of trends, because it showed fairly close agreement with unit time and hunting indices and is believed less influenced by variables.

Mean rabbit population indices obtained during the period of study were greater on the controls where herbaceous ground cover was more abundant. Total area rabbit populations, portrayed in Figure 1, were high in the early years of study, peaked in 1954 and decreased every year to a low level in 1958, also believed representative of the trend occurring in this general region. M-1, B-1 and C-1 fall and winter trends, included in Figure 3, decreased similarly since 1954. M-2, B-2, C-2 and M-3 fall decreases occurred later. Winter observations decreased on all areas, except B-2 (essentially no change) and M-2 tended to increase slightly.

High and increasing rabbit populations were associated with dry to near normal weather conditions during reproduction and decreases with the cool-wet seasons of late. A negative correlation exists between rabbit and fox population trends. Large population drops on C-1 and M-3 followed detrimental land use changes and the increase in habitat on C-2 possibly delayed its decrease. Disease may have contributed to the 1955 rabbit crash in the extreme concentrations occurring on portions of C-1 in high population years. Hunting did not influence populations, since rabbits were grossly under-harvested.

CONCLUSIONS

These is essentially no evidence from the estimated population data, portrayed in Figures 2 and 4 to indicate M-1 perennial plantings, or M-3 annual plots, aided quail or rabbit populations. But the M-2 trends show the possibility of planting benefits to quail in the last two years of study. The statistical analysis of estimated and census data also indicated a population superiority in the post planting establishment period over the pre-establishment period on M-2, as opposed to B-2 and C-2, but this proved statistically insignificant. Only M-2 offered even slight evidence plantings increased rabbits.

It is evident weather during reproduction, land use, quail movements, or possibly predator and other factors have unquestionably influenced quail and rabbit populations much more than could be expected from the management plantings. The level of significance of the M-2 increase may be raised with consideration given to these factors, particularly habitat changes. Habitat deterio-

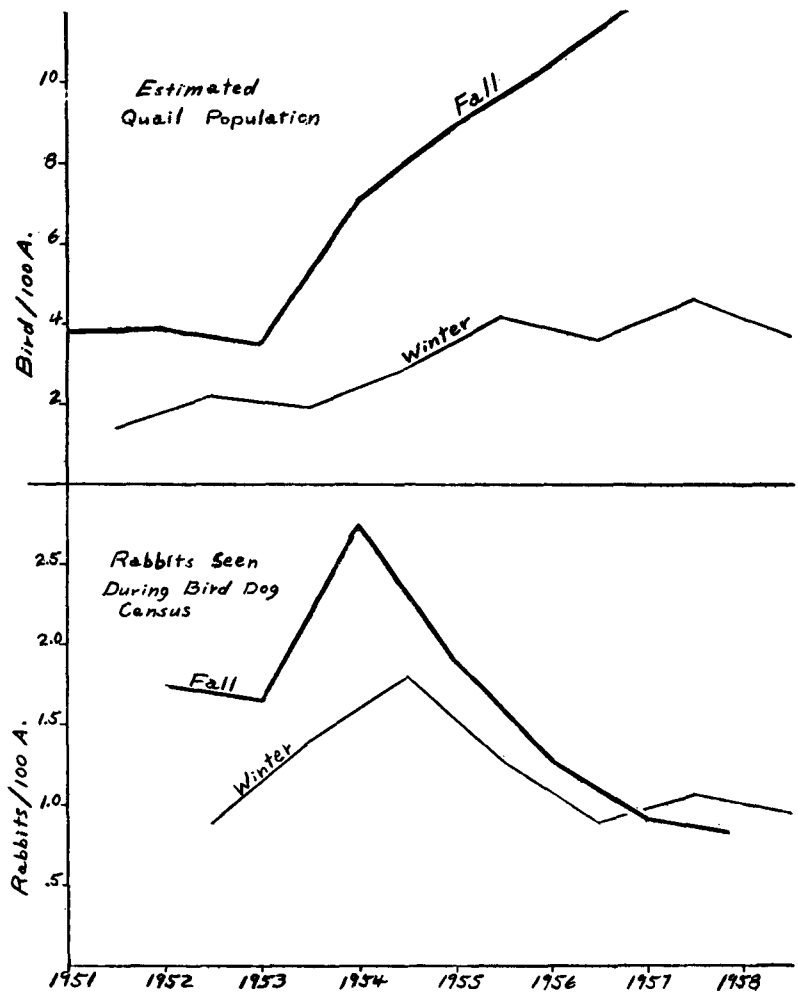

Figure 1. Total study area trends in estimated quail population and rabbits seen during the bird dog census.

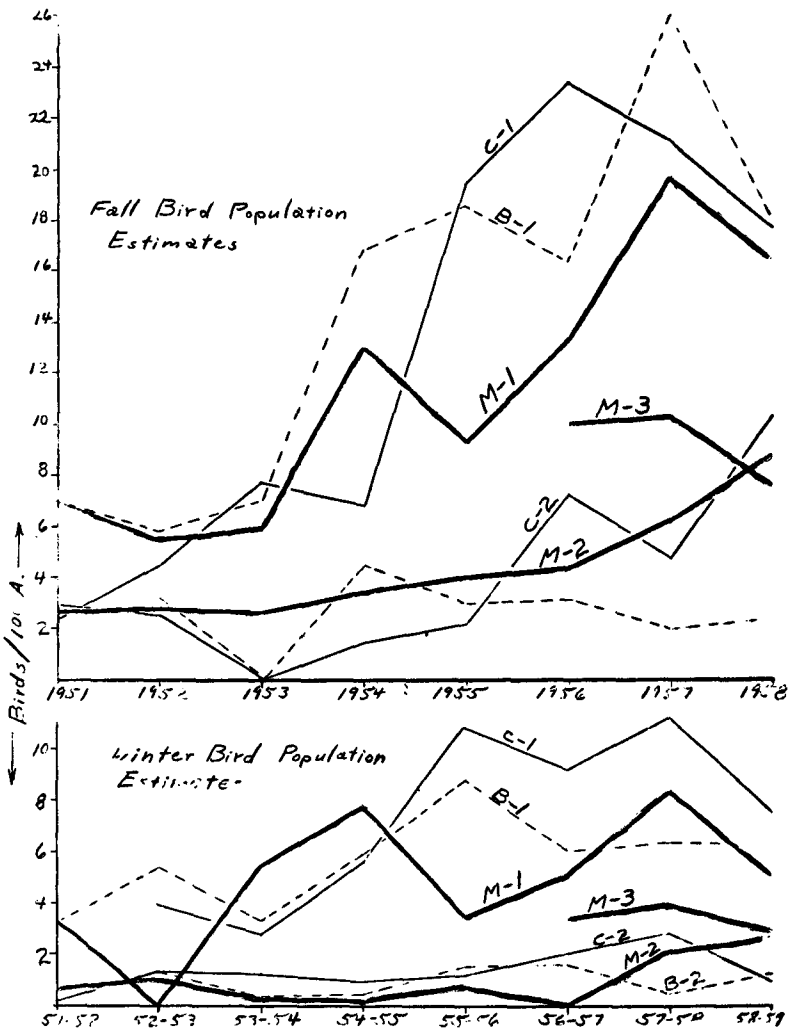

Figure 2. Estimated quail population trends of the study areas (birds/100 A.).

rated similarly on M-2 and B-2, and yet M-2 populations increased with those of C-2, where there was little change in habitat, while B-2 populations decreased.

Why this increase, which the writer believes is real rather than chance, appeared only on the most intensively cropped and grazed area is probably due to the scarcity of fall and winter cover and winter food shortages on M-2. Whereas, effects of the addition of food and cover plantings on the other areas of superior natural habitat were apparently negligible. This generally agrees with the evaluation study findings of Gehrken (1954), Rosene (1956), and Murray (1958), suggesting quail increases could not be expected from bicolor plantings in regions where food scarcity was not a limiting factor.

There is little doubt M-2 game increases were insignificant, commensurate with efforts and expense of planting. Significant increases could hardly be expected from the minute acreage alloted to plantings and without further atten-

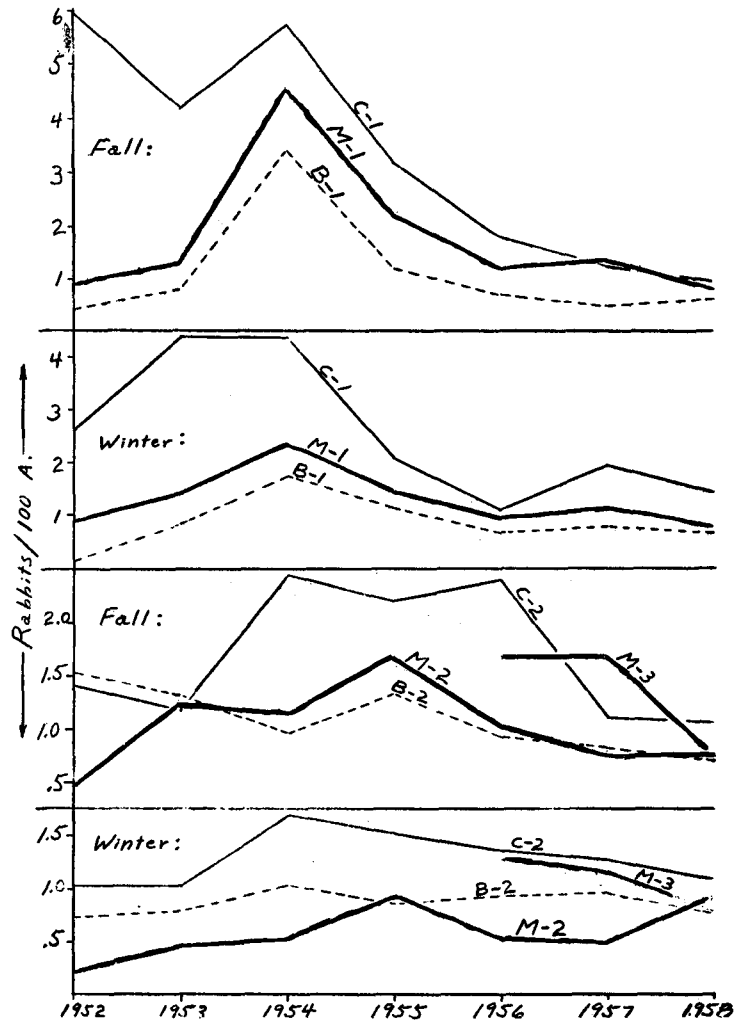

Figure 3. Rabbit population trends indicated by numbers seen/100 acres of study area during the fall and the winter bird dog census.

tion to year-round habitat requirements. Even with greatly improved results on a statewide farm game development program, it is doubtful populations could be increased or barely maintained with present agricultural trends.

ACKNOWLEDGMENTS

The writer is indebted to the numerous state and federal game administrators and field personnel, the study area landowners, and project personnel who aided and afforded continuance of this investigation.

LITERATURE CITED

Durell, James S. 1952. Farm game habitat restoration in Kentucky. Proc. S. E. Assoc. of Game & Fish Comm. Meeting. 13 pp. (Mimeo.).

Gehrken, George A. 1954. Shrub lespedeza as a quail management plant in southeastern Virginia. Proc. S. E. Assoc. of Game & Fish Comm. Meeting. 8 pp. (mimeo.).

Murray, Robert W. 1958. The effect of food plantings, climatic conditions and land use practices upon quail populations on an experimental area in northwest Florida. Proc. S. E. Assoc. of Game & Fish Comm. 11 pp. (mimeo.).

Rosene, Walter, Jr. 1956. An appraisal of bicolor lespedeza in quail management. Journ. Wildl. Mgt. 20(2) :104-110.

APPENDIX

The statistical analysis by Mr. Nall T. Hooks, Jr., of the University of Kentucky, is included in the final report of Project W-28-R, Kentucky Department of Fish and Wildlife Resources. Its length limits reproduction of only the conclusions here:

(1) Conclusions on Plantings' Effects on Quail Population Drawn from Estimated Population Figures.

All comparisons of area M-2 with either of its control areas resulted in insignificant t values when the differences in population increase on the areas were tested. Thus it is concluded that, if there was an actual favorable effect on the quail population level due to the perennial plantings, this effect was not significantly greater than differences between fall to winter population decreases for the four years data examined.

It was unnecessary to statistically analyze areas M-1, B-1 and C-1 to conclude that managed area M-1 was not superior in increase of quail population to either of its control areas. Hence, on area M-1, it can be concluded that the perennial plantings had no measurable effects on estimated quail population level.

(2) Conclusions on Plantings Effects on Quail Population Drawn from Bird Dog Census Figures.

All comparisons of managed area M 2 with either of its control areas, in units of both coveys and birds, which showed possible superior increases from the first two years of the study to the last two years of the study for area M-2 were statistically analyzed by one-tailed t tests of significance.

Since all t values were found to be insignificant, it is concluded that no evidence for favorable effects on quail population by the perennial plantings exists when measured by the bird dog census method.

It is apparent from examining population levels on areas M-1, B-1 and C-1 that managed area M-1 was not superior in the extent of increasing quail population to either of its control areas when measured by the bird dog census. Thus, it is concluded that the perennial plantings produced no measurable effects on quail population level.

(3) Conclusions on Plantings' Effects on Rabbits.

Since the study of the plantings' effects on rabbits was secondary to the effects on the quail population, added to the fact that merely examining annual trends of rabbit population reveals only very slight, if any, evidence that the plantings increased rabbit population, it was decided any additional information that would be gained from statistically analyzing the data would not be worth the effort involved.