MISSISSIPPI QUAIL INVESTIGATION

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HISTORY

Shortly prior to January 12, 1950. the Mississippi Game and Fish Commission acquired the Copiah County Game Area, a tract of 6,900 acres of land situated in the central pine-hardwood hill region. Three hundred sixty acres of this tract were under a sixteenth section lease which expired on June 30, 1954. This lease was not renewed and thus the area presently consists of 6,540 acres.

Approximately 230 acres of this area are in cultivation, 3,170 acres are relatively open abandoned farm land, and 3,140 acres are timbered. Prior to its acquisition by the State Game and Fish Commission the area had been managed for wildlife, timber production, farming and livestock grazing. Previous management for wildlife was exclusively for bobwhite quail and consisted largely of spring burning, moderate grazing, food patch plantings, predator control, controlled hunting, and thinning of brush and timber to improve hunting conditions.

This area is representative of land-use types commonly found in Mississippi and was selected as a study area for quail research because of this fact. Management for bobwhite quail was initiated on January 12, 1950. Since this time a considerable deer population has become established, and a few turkeys are present.

The objectives of the project since its initiation are threefold:

(1) To secure data which will be useful in evaluating the effectiveness and costs of the various quail management techniques which will be employed on the Copiah County Game Area.

(2) To secure data regarding the productivity of quail populations and factors which influence it. (Work accomplished on this objective is not presented in this paper due to the necessary brevity.)

(3) To secure data which will be useful in determining the optimum yield which can be realized from a quail population.

Work has been accomplished by three project leaders. Robert A. Pierce initiated the study on January 12, 1950. On February 29, 1952, he resigned, and Bruce C. Johnson began work on the project. On June 1, 1953, Mr. Johnson was transferred to Columbus, Mississippi, as district biologist and the present leader was assigned to the project.

ACTIVITIES

Mapping the Area

A cover map of the Copiah County Game Area was completed on February 25, 1952, by Robert A. Pierce. This map has been used throughout the period of study for locating and measuring the extent of the various vegetative types present on the area, for recording the locations of the various management practices employed, and for recording the locations and movements of quail.

Rather accurate plotting has been made possible by covering the base map with a grid of lettered and numbered lines spaced in such manner as to enclose areas two and one-half acres in size. Thus any field observation or management practice can be located with the maximum possible error not exceeding 165 feet.

Population Studies

A total of eleven quail censuses, two per year, have been taken on the Copiah County Game Area since the beginning of the project. These have been taken by the use of bird dogs. Since it is impossible to make a thorough population study of the entire area, various census areas have been selected as being representative of the different habitats present. The original census area was the 960 acre tract that had been chosen for intensive research. This was used in March, 1950. For the estimations used from the fall of 1950 through the

spring of 1954, three areas were regarded as being representative of the entire area. These smaller areas were:

(1) A 195-acre tract regarded as being representative of 880 acres of woodland and small open fields which had been burned in November, 1949.

(2) A 100-acre tract representative of 595 acres which were last burned in 1947.

(3) A 1,386-acre tract representative of the remaining 5,425 acres which consist principally of unburned woods and old fields.

Due to the uncontrolled growth of some of the vegetation, especially broomsedge, and the burning program begun in the spring of 1954, the three census areas previously used were considered no longer representative habitats. Therefore, four other areas were selected for census purposes. They were used for the fall census of 1954 and the spring census of 1955 and are described below:

(1) Two areas, one of 363 acres and the other of 275 acres, chosen to represent 3,160 acres that burned in solid blocks in the spring of 1954.

(2) A 360-acre area, the intensive research area, chosen to represent 960 acres that were "spot-burned" in the spring of 1954.

(3) A 185-acre tract chosen to represent the remaining part of the refuge which consists of 2,420 acres of woods and old fields that have not burned since 1949.

The four sample areas contain 1,183 acres or 18.1 percent of the Copiah County Game Area.

The ranges of the various coveys were studied in the field to insure that all border coveys using the various areas were included and that duplicate counts were not made. The areas were repeatedly covered during each enumeration, using well-trained bird dogs.

Densities were calculated by the use of the unique formula:

$$X = \frac{A}{N + \frac{Nx}{2}}$$

Where A equals the number of acres in the area,
N equals the number of quail normally confined to the area in their daily ranging,
Nx equals the number of quail ranging both on and off the area daily.
X equals the density of quail on the area, expressed in number of acres per bird.

To estimate the number of birds in the type of habitat sampled, the total number of acres of a similar nature was divided by X.

Tables I and II give a summary of the population studies expressed in acres per bird on the Copiah County Game Area since the initiation of the project.

TABLE I

POPULATION STUDIES—SPRING, 1950 THROUGH SPRING, 1954

	Unburned Woods	*Burned Woods*	*Old Fields and Woods*	*On Entire Area*	*Total No. of Birds*
Spring, 1950	. .	. .	7.3	. .	700
Fall, 1950	6.1	3.1	5.7	5.2	1,337
Spring, 1951	7.7	3.8	7.8	6.8	1,008
Fall, 1951	7.7	3.3	5.4	5.1	1,351
Spring, 1952	7.7	3.5	6.9	6.2	1,114
Fall, 1952	5.6	3.4	5.4	5.0	1,369
Spring, 1953	5.6	3.8	5.8	5.4	1,277
Fall, 1953	4.5	7.5	3.7	4.1	1,699
Spring, 1954	6.5	6.6	5.8	6.6	1,051

TABLE II

POPULATION STUDIES—FALL, 1954 AND SPRING, 1955

	Burned in Solid Blocks	*"Spot Burned"*	*No Recent Burning Record*	*On Entire Area*	*Total No. of Birds*
Fall, 1954	2.7	2.7	5.4	3.32	1,974
Spring, 1955	5.6	7.8	6.4	6.1	1,065

Table III gives the percentage of increase from the fall census of one year until the following fall census.

TABLE III

PERCENTAGE OF INCREASE OF QUAIL FROM THE FALL CENSUS OF ONE YEAR UNTIL THE FOLLOWING FALL CENSUS

1950 1951	*1951 1952*	*1952 1953*	*1953 1954*	*1954*
1	1.3	24.1	16.2	

It is not believed that the 1,974 birds found on the area in December, 1954, represent the maximum carrying capacity. It is the opinion of the study leader that the burning activities of the spring of 1954 reduced the broomsedge and brought in native foods thereby holding the birds on the area. Crop analyses of the birds bagged during a recent hunt give proof of the utilization of native foods. The planted food plots of 1954 were considered very poor. The press of other activities prevented the refuge manager from devoting much time to food-plot care. Damaging drought conditions also existed during this period. The burning of 1,980 acres in February 1955 that had not been burned since the initiation of the project and 640 acres that were burned in 1954 is expected, together with excellent food plots in 1955, to hold an increased population during the winter of 1955.

TRAPPING

Trapping records and the recovery of dead banded birds bear out the general knowledge that the quail is a sedate bird. There is considerable movement by the birds but it is all local.

Three hundred seventy-six birds have been live-trapped, banded, and released at the trapping sites. One hundred forty-two of these have been retrapped one or more times, found dead or shot. In all but a very few cases the exact location of every observation has been recorded on the grid map. These few exceptions were birds killed during the controlled hunt. Hunters were not able to give the exact location of where a few birds were taken.

Distances moved by individual birds between observations may be broken down as follows:

91 birds—no more than one-fourth mile
39 birds—more than one-fourth mile but less than one-half mile
8 birds—more than one-half mile but less than one mile
4 birds—more than one mile (two and one-half miles maximum)

Of the 97 birds that moved one-fourth mile or less, 30 (33 percent) were hens and 61 (67 percent) were cocks. One hen and seven cocks moved more than one-half mile but less than one mile. One hen and three cocks were retaken more than one mile from their banding sites. Numbers in the two latter groups are too small for conclusions but it can be said that the cock birds exhibit a greater tendency to move than the hen. The records show that most of this movement takes place between the covey breakup in the spring and the covey formation in the fall.

FOOD STUDIES

A study was made from March, 1952 to March, 1953 of the foods available in the field.

Attention was given to the first ripening dates of seeds of quail food plants from June, 1953 through October, 1953. Seeds from these plants were collected in 30 cc. vials and labeled. These are listed and the approximate ripening dates of each given in Table IV. The list is not a complete one. Some of the more important and many of the less common ones are not included.

Twelve quail were taken during the year July 1, 1953, to June 30, 1954, for crop analyses. No study was made of the volume-frequency relations of the contents. Seventeen unidentified seed specimens were sent to Mr. A. C. Martin of the Patuxent Research Refuge at Laurel, Maryland, for identification. They were identified by Mr. Martin as follows:

Lespedeza striata
Lespedeza stipulacea
Lespedeza virginica
Desmodium sp.
Rhus copallina sp.
Croton capitatus
Croton punctatus
Berchemia scandens
Paspalum dissectum
Paspalum floridanum
Paspalum ciliatifolium
Galactia sp.
Diodia teres
Scleria sp.
Jacquemontia sp.
Carpinus caroliniana

In addition to the list above *Lespedeza bicolor,* partridge pea, oats, and vetch were found. Two of the birds killed in early summer had a dominance of oats and vetch in their crops.

TABLE IV

FIRST RIPENING DATES OF SEED OF FOOD PLANTS ON COPIAH COUNTY GAME AREA

Species	*Ripening Dates June through October*				
	June	*July*	*Aug.*	*Sept.*	*Oct.*
Brown top millet *			5		
Cat-tail millet *				1	
Cowpeas (clay)*			20		
Cowpeas (red ripper)*			20		
Sesbania *				12	
Grain sorghum *				5	
Wild sweet pea (*Cracca* sp.)		20			
Rattle-box (*Crotalaria* sp.)		25			
Fox-tail grass (*Seteria* sp.)			30		
Partridge pea (*Cassia fasciculata*)			10		
Butterfly pea (*Centrosema virginiana*)			25		
Butterfly pea (*Clitoria mariana*)			25		
Johnson grass (*Sorghum halapense*)			15		
Grass, two species (*Paspalum* spp.)			1		
Wild plum (*Prunus* sp.)	1				
Winter huckleberry (*Vaccinium* sp.)				15	
Beggarlice (*Desmodium* sp.)					1
Bush lespedeza (*Lespedeza* sp.)					1
Ragweed (*Ambrosia* sp.)					1
Post oak acorns (*Quercus stellata*)					10

The most extensive study of the utilization of foods was made from the crop contents of 360 of the birds killed during the controlled hunt of December, 1954 and January, 1955. The contents of these crops were placed in pill boxes and dried. At a later date the seeds were identified by Dr. A. D. Suttle and his staff of the Mississippi Seed Laboratory. The seeds of 50 species of plants were identified. Nineteen of those used most frequently and in greatest volume, plus insects parts, are listed in Table V. "An additional number which is here called the 'volume-frequency index,' is also given in the table. There appears to be a need for some method of expressing the significance of frequency. The almost universal practice of ranking the foods of game birds

* Cultivated plants.

according to volume alone largely ignores frequency." (Baumgartner *et al.*, 1952.) As a specific example of the importance of frequency, the status of beggarweed may be compared with common lespedeza. As is shown in the table, common lespedeza ranking second in volume eaten would be considered of greater importance than beggarweed in spite of the lower frequency rating (fourth place). Beggarweed ranks fourth in volume and second in frequency, the volume-frequency index number is obtained by dividing the sum of the rank in volume and frequency by two. The index of common lespedeza is $\frac{2 \text{ plus } 4}{2}$ which equals 3. Beggarweed has an index of $\frac{4 \text{ plus } 2}{2}$ which equals 3. Thus it can be seen that when both volume and frequency are considered, beggarweed and common lespedeza are of equal importance as quail foods on the Copiah County Game Area. It is desired that attention be given to *Lespedeza virginica,* which is not generally considered a preferred food by quail as compared with acorns. It has an index rank immediately below acorns in spite of the fact that it made up only 2.2 percent of the volume as compared with 10.2 percent for acorns.

TABLE V

ANALYSIS OF CROPS OF 360 QUAIL KILLED ON THE COPIAH COUNTY GAME AREA DECEMBER, 1954 AND JANUARY, 1955 *

Food	*Volume*	*Frequency*	*Index*
Cassia fasciculata (Partridge pea)	21.3	55	1
Desmodium spp. (Beggarweed)	11	54.4	3
Galactia spp. (Milk pea)†	7.3	47.2	4.5
Lespedeza spp. (Common)	18.6	37	3
Lespedeza virginica (Bush clover)	2.2	29.4	7
Lespedeza bicolor	15.7	18.3	4.5
Quercus spp. (Oaks)	10.2	13.3	6
Croton spp. (Goat weed)	2.9	10.3	7.5
Ambrosia spp. (Ragweed)	1.0	8.1	10
Scleria (Nutrush)	0.1	7.2	12
Rhus copallina (Sumac)	1.6	5.6	10
Panicum spp. (Panic grass)	0.0	5.6	15.5
Diodia teres (Buttonweed)	0.1	4.4	13.5
Paspalum spp.	0.0	3.6	14.5
Apios spp. (Wild Bean)	0.9	2.8	13.5
Vigna sinensis (Cow peas)	2.9	1.4	11.5
Zea mays (Corn)	0.7	1.4	14.5
Lespedeza sericea	0.0	1.1	16
Vicia hirsuta (Hairy vetch)	0.1	1.1	15.5
Insect parts (Mostly grasshoppers)	1.1	5.0	11

A reminder should be inserted here that four of the first five species, milk pea excluded, rated according to frequency, are probably the result of burning activities of February and March, 1954. The vegetation of the area had been dominated by broomsedge. The burning of 4,120 acres resulted in the growth of a good crop of partridge pea, beggarweed, common lespedeza and bush clover (*Lespedeza virginica*).

HARVESTS

One hundred fifty (seventy-five pairs) quail were live trapped and removed from the area in the early spring of 1954 for a statewide restocking program. These are considered as harvested birds.

The controlled hunt of December, 1954-January, 1955 is considered the first and only true harvest of quail from the area. Plans for the hunt were made in September and were advertised in the Jackson, Mississippi papers and in the *Mississippi Game and Fish.* The regulations for the hunt were also published and a copy of them was sent with each application blank that was requested.

The hunt was scheduled for six days in December, 1954; however, the desired number of birds to be harvested were not bagged by the hunters during

* Volume and Frequency are expressed as percentages.
† This group included a small quantity of seeds from closely related genera.

these six days, and a second hunt was scheduled for 13 days in January. The data given here are taken from both hunts.

Three hundred forty-four hunters from 33 counties of the state came for the hunt. They killed 535 birds, an average of 1.56 birds per hunter. Two hundred seventy-five (51.2 percent) were cocks, and 260 (48.8 percent) were hens. One hundred twenty-one (23.4 percent) of the 519 birds that were aged, 67 cocks and 54 hens, were one or more years old. Three hundred ninety-eight (76.6 percent) of those aged, 206 cocks and 192 hens, were birds of the current year.

The average weight of all birds was 165.3 grams. The cocks averaged 165.8 grams and the hens 164.5 grams. These figures are slightly less than they should be since a few hunters drew the viscera from their birds in the field and no allowance was made for this in weighing. The heaviest hen weighed 192 grams and the heaviest cock 200 grams.

Thirteen banded birds were killed by the hunters. The hunters were questioned about the location of the place where these birds were killed. The greatest distance from the banding site of any of them was about one and one-fourth miles. One bird was killed 300 yards from the site where he was banded on June 15, 1951.

Given below is a summary of the data collected during the hunt:

Number of hunters	344
Man-hours hunted	1,494
Number of quail bagged	535
Number of unretrieved dead	57
Number of flying cripples	78
Number of man-coveys observed	682
Number of shots fired	1,353
Number of hunters getting 0 birds	150
Number of hunters getting 1 bird	67
Number of hunters getting 2 birds	45
Number of hunters getting 3 birds	31
Number of hunters getting 4 birds	19
Number of hunters getting 5 birds	12
Number of hunters getting 6 birds	6
Number of hunters getting 7 birds	7
Number of hunters getting 8 birds	8

With but few exceptions men hunted in parties of two or three, using generally, one, two, or three dogs. Table VI gives the relationship of the number of men in the party and the number of dogs used to the average kill per party.

TABLE VI

RELATIONSHIP OF NUMBER OF MEN AND DOGS IN HUNTING PARTY TO AVERAGE NUMBER OF BIRDS KILLED PER PARTY

	One Dog	*Two Dogs*	*Three Dogs*
Two Men	4.8	2.2	3.7
Three Men	1.3	3.1	4.3

There were only ten parties of two men each using one dog. Two of these parties had an exceptionally good dog and the men are known to be good shots. These two parties killed 29 of the 48 birds killed by parties of two men. Excepting this first line of column 1, it is obvious that individual hunter success is better in parties of two men than three men.

The hunter success was disappointing. This is believed to be due to the fact that both hunters and dogs were not accustomed to hunting in cover as dense as was found here. Most hunters complained of the dense cover. This situation has been partially remedied by burning activities since the hunt. Also, lanes for dogs and men adjacent to and through thickets have been cut with a rotary mower and a disk.

It is the opinion of the study leader that at least three additional similar hunts will be necessary before sufficient data will be obtained to determine the optimum yield which can be realized from a quail population.

SUMMARY OF IMPROVEMENT PRACTICES

Seventy *Lespedeza bicolor* plots are well established on the area. Most of these were planted during the first and second years of the project. They will average well above the minimum recommended size one-eighth acre.

Millet, grain sorghums, sesbania, and cow peas have been planted annually. Presently there are 121 plots of these annuals. The locations of these plots are changed from year to year in order to partially combat the competing broomsedge.

Due to the uncontrolled growth of broomsedge, it was necessary to begin a burning program in the late winter of 1954. At that time 3,160 acres were burned in several large blocks. An area of 960 acres was marked off in blocks by fire lanes placed one-fourth mile apart. These blocks (40 acres each) were burned in a checkerboard pattern in March of 1954. (The alternate forties were burned in 1955). A total of 4,120 acres were thus burned in 1954. The program was continued in 1955 by burning 2,620 acres. Of this area 640 acres had been burned in 1954. The entire area has been burned since February, 1954, except 800 acres of upland timbered land.

CONCLUSION

We believe that as a result of former development, plus a continuation of our present practices, the Copiah County Game Area can continue to support a fall quail population equal to or greater than that of 1954. The over-wintering population will remain on the area as a breeding population for the following summer.

We further believe that we are now in position to demonstrate quail management techniques which may be used on public and private lands throughout the state.

ROLE OF GAME MANAGERS IN GAME AND FISH LAW ENFORCEMENT ON THE NATIONAL FORESTS IN VIRGINIA

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The Commonwealth of Virginia entered into a cooperative agreement with the United States Forest Service for the management of wildlife as a result of legislation passed by the 1937 General Assembly. During this same period, the U. S. Forest Service was conducting a program of land acquisition in the mountainous counties of Virginia which culminated in the creation of the George Washington and Jefferson National Forests. While the underlying objectives in this acquisition program were watershed protection and timber production, it was quickly recognized by Virginia conservation leaders that this vast public domain of more than a million and one-half acres offered an unparalleled opportunity to initiate a comprehensive system of wildlife management.

One of the first steps that paved the way and set an example for cooperative work on the Forests was the establishment of the Big Levels Wildlife Management Area on the George Washington National Forest. The wildlife rights on this area were ceded to the Federal Government by the General Assembly of Virginia. As a result of experiments tried on this area, plans were developed to be applied to other areas. Please remember that this was back in the period of 1935 to 1938.

Various techniques for financing the wildlife program on the Forests about this time were discussed. The sportsmen were approached to help form a plan to make the wildlife program on the Forests self-supporting. Thus a plan was devised whereby the sportsmen using the Forests were charged an additional