

Also, it was observed that the hunters had difficulty in locating downed doves in dove proso. One advantage of the robust growth of dove proso is that it provides cover for hunters in the fields. If dove proso is not planted for hay purposes, alternating strips of dove proso and browntop millet would provide more attractive feeding conditions than solid plantings of dove proso. Some landowners are planting 10- to 20-foot strips of dove proso and disking the unplanted area between the strips to provide bare ground for attracting doves.

Dove proso matures at a slower rate than browntop millet and should be planted about 90 to 100 days before the opening of the dove season. A number of landowners in South Carolina planted dove proso and browntop millet at the same time (usually the first week in July), and the dove proso did not mature in time for the first dove season.

The data obtained in this study revealed that dove proso is a choice mourning dove food.

#### LITERATURE CITED

- Davison, V. E. 1940. A field method of analyzing game bird foods. *J. Wildl. Mgmt.* 4(2): 105-116.
- Fernald, M. L. 1950. *Grays manual of botany*. American Book Company, New York. 1632 pp.
- Martin, A. C., R. H. Gensch, and C. P. Brown. 1946. Alternative methods in upland gamebird food analysis. *J. Wildl. Mgmt.* 10(1): 8-12.
- \_\_\_\_\_, and W. D. Barkley. 1961. *Seed identification manual*. Univ. of California Press, Berkeley and Los Angeles. 221 pp.
- Neely, W. W. 1961. Dove field management. *Proceedings of the southeastern conference on management of game birds*. Univ. of Georgia, Athens, Georgia.
- Radford, A. E., H. E. Ahles, and C. R. Bell. 1964. *Vascular flora of the Carolinas*. The Book Exchange, Univ. of North Carolina, Chapel Hill, N. C. 383 pp.
- U.S.D.A. 1964. Proso millet (*Panicum miliaceum*). *Soil Conservation Service, Plant Materials Guide*, Forth Worth, Texas. 2 pp. Multilith.

## RECOVERY DATA FROM PEN-RAISED QUAIL RELEASED BEFORE AND DURING THE HUNT SEASON<sup>1</sup>

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### ABSTRACT

A total of 1,915 bobwhite quail (*Colinus v. virginianus*) was released on Belmont Game Management Area in South Carolina from 2 to 10 weeks prior to the advent of the 1969 hunt season. An additional 1,134 quail were released on the same area during January and February, 1970. The overall study area had been sub-divided into nine smaller compartments for "release" and "hunting" purposes. The hunting season extended from November 24, 1969 through March 2, 1970. Recovery data showed that 33.52 percent of the quail released prior to the hunting season were harvested during the hunting season. The quail recovered from the releases made late in the legal season represented 37.57 percent of the quail released during this period. Data recorded on flight

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characteristics of the pen-raised quail were believed to be biased, but other information obtained verbally indicated that the earlier released birds possessed greater qualities as game birds. Movement data showed that the quail released in each of nine release areas within the 5,700 acre plantation were eventually recovered from almost all of the other release areas within the study area.

For several years prior to 1969, the South Carolina Wildlife Resources Department had advocated and, to a lesser extent, utilized the technique of releasing pen-raised bobwhite quail (*Colinus v. virginianus*) on selected areas to increase the quail harvest. The pen-raised quail were often released on the areas as soon as they were flight conditioned, with this condition being attained as early as mid-July and as late as mid-November. In other situations the quail were retained in rearing or flight training pens until a few days before being released for hunting throughout the regular season.

These practices raised several questions regarding the best time to release the quail. Of primary concern were the recoveries that could be expected from quail released several weeks prior to the legal season as compared to those recoveries realized from quail released just prior to hunting. Another question involved the movement of the released quail from one area to another before being harvested. A third question concerned the relative flight characteristics of quail released prior to the hunting season in comparison with those released immediately before hunting was to take place.

With these main questions in mind, the South Carolina Wildlife Resources Department initiated a study in 1969 to provide data on some of the problems confronting land owners who desire to use pen-raised quail to increase their quail harvest. The state-owned Belmont Game Management Area (Figure 1), located in the southwestern part of the state and containing approximately 5,700 acres, was selected for the study area.

#### METHODS AND TECHNIQUES

The operations at the game bird hatchery on Belmont Management Area were expanded to provide the quail needed for the study. Additional breeding birds and the necessary equipment were obtained to raise the production of releasable quail to approximately 3,000. This estimated requirement of releasable birds was based on the assumption that the native population on the area would approximate 2,500 quail; thus raising the overall population of the area to approximately one bird per acre.

A total of 3,049 quail was eventually raised, banded, and released for the study. However, hatchery productions were not uniform throughout the breeding season, and on some occasions the number of quail ready for release was not as high as desired (Tables 1 and 2).

The original plan was to release about 2,000 quail prior to the hunting season, with the remaining 1,000 being retained for release during the latter part of the season when the population level had subsided. The quail releases were usually made twice weekly, but computations of the release data were grouped into weekly periods. The initial release was made on September 29, 1969, with the "prior-season" releases extending through November 9. A total of 1,915 quail was released during this period. The legal shooting season opened on November 24. The "in-season" releases were initiated on January 5, 1970 and continued through March 2, when the quail hunting season closed. A total of 1,134 quail was released during the latter release period (Table 1). All releases were made in covey size groups and usually near feeders stocked with sufficient quantities of various quail foods.

Prior to the release of any quail on the study area, the area was subdivided into nine hunting compartments (Figure 1). Records maintained on each banded quail showed the compartment in which the release was made as well as the total number of quail eventually released in each compartment (Table 3) and the dates on which releases were made.



TABLE 1. Recovery of released banded quail by weekly periods of the legal season November 24, 1969-March 2, 1970, Belmont Plantation, Garnett, South Carolina.

Release Dates	No. Rel.	Total % Rec.	Number of banded quail recovered during 15 weekly periods of hunting season															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
9/29-10/5, 1969	480	32.3	29	12	24	11	6	20	8	6	8	13	7	1	1	1	9	0
10/6-10/12, 1969	480	40.8	38	28	24	20	11	8	5	4	8	22	10	4	4	8	2	2
10/13-10/19, 1969	478	27.2	35	12	13	8	4	8	13	7	5	14	7	1	3	0	0	0
10/27-11/02, 1969	140	26.4	8	10	4	1	9	0	0	0	2	0	1	0	0	2	0	0
11/3-11/9, 1969	337	36.8	37	10	12	13	8	8	9	10	2	1	5	2	1	5	1	1
Sub-total	1,915	33.5	147	72	77	53	38	44	35	27	25	50	30	8	9	24	8	8
1/5-1/11, 1970	189	40.2						55	14	5	2	1	2	1	0	0	0	0
1/12-1/18, 1970	99	63.6							29	24	5	3	1	1	0	0	0	0
1/19-1/25, 1970	164	14.6								21	2	2	1	0	0	0	0	0
1/26-2/1, 1970	297	31.0									47	34	6	1	4	0	0	0
2/2-2/8, 1970	200	43.5											61	23	3	0	0	0
2/9-2/15, 1970	99	57.6												55	0	1	1	2
2/16-2/22, 1970	25	64.0																
2/23-3/1, 1970	4	0.0																
3/2-3/8, 1970	47	14.9																
Sub-total	1,184	37.6							55	43	50	56	100	87	19	6	10	10
GRAND TOTAL	3,049	35.0	147	72	77	53	38	44	90	70	75	106	130	95	28	30	13	13

TABLE 2. Percent of banded quail recovered during weekly period during legal season, November 24, 1969-March 2, 1970, Belmont Plantation, Garnett, South Carolina.

Release Dates	No. Rel.	No. Rec.	Total % Rec.	Percent of banded quail recovered during 15 weekly periods of hunting season *														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
9/29-10/5, 1969	480	155	32.3	18.7	7.7	15.5	7.1	3.9	12.9	5.2	3.9	5.2	8.4	4.5	0.6	0.6	5.8	0.0
10/6-10/12, 1969	480	196	40.8	19.5	14.3	12.2	10.2	5.6	4.1	2.6	4.1	11.2	5.1	2.0	2.0	4.1	1.0	1.0
10/13-10/19, 1969	478	130	27.2	26.8	9.2	10.0	6.2	3.1	6.2	10.0	5.4	3.8	10.8	5.4	0.8	2.3	0.0	0.0
10/27-11/2, 1969	140	37	26.4	21.7	27.0	10.8	2.7	24.3	0.0	0.0	0.0	5.4	0.0	2.7	0.0	0.0	5.4	0.0
11/3-11/9, 1969	337	124	36.8	29.7	8.1	9.7	10.5	6.5	7.3	8.1	1.6	0.8	4.0	1.6	0.0	0.8	4.0	0.8
Sub-total	1,915	642	33.5	22.9	11.2	11.9	8.3	5.9	6.9	5.5	4.2	3.9	7.8	4.7	1.2	1.4	3.7	0.5
1/5-1/11, 1970	199	80	40.2						68.9	17.5	6.2	2.5	1.2	2.5	1.2	0.0	0.0	0.0
1/12-1/18, 1970	99	68	68.6						46.0	88.1	7.9	4.8	1.6	1.6	0.0	0.0	0.0	0.0
1/19-1/25, 1970	164	24	14.6							87.5	8.3	4.2	0.0	0.0	0.0	0.0	0.0	0.0
1/26-2/1, 1970	297	92	31.0								51.1	37.0	6.5	1.1	4.3	0.0	0.0	0.0
2/2-2/8, 1970	200	87	43.5									70.2	26.4	96.5	0.0	1.8	1.8	1.8
2/9-2/15, 1970	99	57	57.6															
2/16-2/22, 1970	25	16	64.0															
2/23-3/1, 1970	4	0	0.0															
3/2-3/8, 1970	47	7	14.9															
Sub-total	1,134	426	37.6							12.9	10.1	11.7	13.1	23.5	20.4	4.5	1.4	2.4
GRAND TOTAL	3,049	1,068	35.0	13.8	6.7	7.2	5.0	3.6	4.1	8.4	6.6	7.0	9.9	12.2	8.9	2.6	2.8	1.2

\* The total percent of banded quail killed each week represents a percent of total quail recovered and is not related to the number of quail that had been released at the time.

TABLE 3. Dispersion of released banded quail recovered in individual areas 1969-70, Belmont Plantation, Garnett, South Carolina.

Release Area	Number Released	Banded Birds		AREA COVERED								
		Recovered	Unknown	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9
Area 1	219	65	3	35	2	7	1	8	4	2	1	2
Area 2	158	40	1	6	28	0	0	2	1	1	1	1
Area 3	577	165	6	1	2	78	19	49	10	0	0	0
Area 4	629	211	4	9	5	85	21	52	32	1	2	0
Area 5	391	154	4	9	0	30	7	83	18	2	1	0
Area 6	559	170	0	2	4	22	18	27	43	2	50	2
Area 7	239	77	1	3	2	0	0	9	0	34	1	27
Area 8	199	62	0	1	3	1	0	7	26	0	24	0
Area 9	78	9	1	0	0	0	2	4	0	2	0	0
Area Unknown	0	115	0	1	10	28	7	33	33	0	3	0
TOTAL	3,049	1,068	20	67	56	251	75	274	167	44	88	31

failed to record all of the information requested. In such instances, these data were omitted from the program or classed as being "unknown". The IBM program was prepared by Larry E. Warlick, a former graduate student in wildlife biology at Clemson University and who, at the time, was an instructor in the Department of Experimental Statistics at the University.

## RESULTS

A total of 1,918 quail was harvested on the study area during the 1969-70 hunting season. Of this total harvest, 1,068 (55.7 percent) were from the released pen-raised birds. The harvested pen-raised quail represented approximately 35 percent of the 3,049 quail released on the study area (Tables 1 and 2).

Of the 1,915 pen-raised quail released in 1969 prior to the opening of the quail season, 642 (33.52 percent) were harvested during the legal 1969-70 season. During the same season 426 of the 1,134 (37.57 percent) quail released during the hunting season were harvested. In relation to the weekly release periods, the recovery of banded quail varied from 0 percent (February 23—March 2) to a high of 64 percent from those released during the week of February 16-22, 1970. Actually, the data showed that the percent of banded quail recovered from those released during the various weekly release periods varied considerably and showed no definite trends (Tables 1 and 2).

The number of banded quail harvested during each week of the hunting season is shown in Table 1, with comparable percentages being depicted in Table 2. These data indicate that the recovery of banded quail extended throughout the season with one peak occurring during the first 3 weeks of the hunting season and another peak during the 10th, 11th, and 12th weeks of the season. A closer examination of the data in Table 1 (calculations not presented) revealed that 56.6 percent of all the banded quail recovered were killed during the first 2 weeks of the season and during the first 2 weeks following the release dates that occurred during the latter part of the season.

The information received on flight characteristics of the released quail was considered to be invalid due to the few responses from the participants, and the consistency with which the remarks were limited to "good". For example, of 35 participants that commented on the flight characteristics of the quail, 33 reported "good", one reported them as being "fair", while another one stated that the flight characteristics were "bad".

The recovery data showed that considerable movement took place after the quail were released regardless of where or when the quail were released within the study area. Of the banded quail released in six of the nine hunt areas and recovered during the study, over 50 percent were killed in areas other than the one in which they were released. The data also showed that some of the quail released in each of the areas were eventually recovered in practically every other hunt unit (Table 3).

## DISCUSSION AND CONCLUSIONS

The data obtained in this study indicate that there was little difference in the percent recovery of pen-raised quail released 2 weeks to 2 months prior to the advent of hunting season and those released a few days before the actual shooting during the latter part of the hunting season.

The weekly kill of pen-raised quail was found to vary throughout the 15 weeks of the hunting season. These variations were probably due to a number of factors such as varying hunting pressure, weather conditions, quality of dogs used, and the difference in the desire and ability of participants to kill native or pen-raised quail.

The information obtained on flight characteristics of the released quail left much to be desired. Although most of the participants reported that the flight characteristics were "good", many of the hunters visited the study area only once during the season and many may have hesitated to criticize the shooting for fear of not being invited to hunt

again. However, from personal conversations with several hunters that hunted in the study area during both the early and latter periods of the season, the authors were assured that the flight characteristics of the quail released prior to the legal season resembled more the characteristics of native quail. These hunters also stated that the flight habits of the quail released just prior to hunting left much to be desired.

Data obtained on the movements of pen-raised quail after their release indicate that they will move. Since the quail released in each of the nine release areas were recovered throughout most of the remainder of the study area, and since there was no apparent concentration of the quail within a specific area, no conclusions can be made regarding the causes of such movements. Possibly some of this movement was prompted by the need for the quail to know the area in which they were to live, and such should be considered when attempting to release quail on a small area with the expectation of them remaining close to the release site. Of course, some of the movements could have resulted from a search for a better habitat.

In the opinion of the authors, pen-raised birds should be released, when possible, well in advance of the quail hunting season. While the percent of quail recovered may be slightly lower than that realized from quail released just before hunting, the quality, size and palatability of the earlier released quail may greatly offset any other advantages thought to be obtained from the "release and shoot" technique.

## **BOBWHITE QUAIL: TOTAL HUNTER KILL COMPARED TO NUMBER RETRIEVED<sup>1, 2</sup>**

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### **ABSTRACT**

Thirty-one different hunters using 24 different bird dogs flushed 5691 bobwhites (*Colinus virginianus*) in 572 man hours of hunting. Hunters fired 2639 shots and retrieved 846 bobwhites (3.1 shots/bird retrieved). For every three birds in the bag, one dead or crippled bird was left in the field. All hunting was done on an area which had a bobwhite density greater than one bird per acre.

### **INTRODUCTION**

During management studies of bobwhite quail, the authors found it necessary to determine mortality due to hunting since a total kill of approximately 25 percent of the population was desired. Figures derived from this study should be generally applicable to quail hunting on other private lands as well as game management areas operated by state agencies.

### **METHODS**

The study site consisted of approximately 1100 acres located in a limestone region of broken terrain in northern Leon County, Florida.

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<sup>2</sup> Presented at the annual meeting of the Southeastern Association of Game and Fish Commissioners in Charleston, South Carolina, October 17-20, 1971.