

By now it should be possible to recognize the signs of an approaching buildup of peak populations of bobwhites in the Lower Plains, and to adjust hunting regulations to permit harvesting a greater portion of the surplus. When eruptive populations of bobwhites occur again in the Lower Plains, it would be wise management to open the season much earlier, perhaps October 1, and to liberalize bag and possession limits.

With a greater part of the Lower Plains now under regulatory management of the Texas Game and Fish Commission, the above presents no great problem in itself. The bigger problem is to persuade ranch owners to allow more than the present token amount of hunting permitted on a vast aggregate acreage where the great waste of surplus quail occurs.

#### REFERENCES CITED

- Jackson, A. S. 1947. A bobwhite quail irruption in northwest Texas Lower Plains terminated by predation. Trans. 12th North American Wildlife Conference.
- Lehmann, V. W. 1953. Bobwhite population fluctuations and vitamin A. Trans. 13th North American Wildlife Conference.

## COTURNIX QUAIL INVESTIGATIONS IN KENTUCKY \*

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### INTRODUCTION

In 1955 a new exotic game bird exploded on the midwestern scene with a terrific bang. It was the Japanese subspecies of the coturnix quail (*Coturnix coturnix japonica*), also known as the Old World quail or the Japanese quail, a migrating bird in its native range. Accompanying publicity, largely because of its amazing prolificness under penned conditions, heralded it as the answer to the wildlife manager's and gunner's problem. The need for increased targets for sportsmen would be solved by this bird, we were informed. Grossly exaggerated and misleading publicity provided fuel for demanding sportsmen to besiege state conservation agencies with requests to obtain breeding stock and begin mass releases as soon as possible.

Following the precedent established by investigations of two other exotics, the ring-neck pheasant and the chukar partridge, Kentucky's work with this new bird was placed in a research study. Here, releases were kept to a minimum and confined to selected habitat types with intensive follow-up studies by trained personnel.

Breeding stock was obtained from the Missouri Conservation Commission in the spring of 1956. Originally, Missouri obtained 70 pairs from a California importer in the spring of 1955. These birds were three generations removed from stock originally shipped from Japan. During the summer of 1955 the Missouri Commission reared four generations of young and it was from these progeny that Kentucky's stock was procured. Birds were also distributed to Tennessee, Oklahoma, Alabama, Ohio, Nevada, Virginia, Georgia, Illinois and Indiana.

Kentucky's study was initiated on May 1, 1957 as a phase of Pittman-Robertson Project W-34-R, Exotic Game Bird Investigations. A reorganization of P-R projects resulted in the termination of W-34-R on July 1, 1959, at which time the study was incorporated as a phase in Project W-38-R, Special Problems Investigations, which embodied all game research.

The objectives of the study were to determine the survival rates and influencing factors of released pen-reared Japanese coturnix quail in Kentucky. The findings were to be used in the formulation of coturnix management meas-

\* A Contribution of Kentucky Federal Aid Projects W-34-R and W-38-R.

ures or as informational material to discourage future liberations of this subspecies.

Representative release areas were selected in the various major habitat types occurring in Kentucky. Two of the areas (Henderson and Owensboro) were located along the Ohio River in the western division of the Appalachian Plateau. The Bourbon area was typical of the Bluegrass type. The Kleber Songbird Sanctuary and the Jessamine County area were situated in the Bluegrass Hill section. The Cumberland area was located in the Eastern Appalachian Plateau. The Saloma, Todd County and Fort Campbell areas were selected as typical of the gently rolling upland land-type found in the Mississippian Plateau.

The Bourbon, Henderson, Todd and Saloma study areas consisted of rectangular blocks, each totaling approximately 48 square miles (six by eight miles). Twenty release sites, spaced two miles apart, were spotted on county maps. Releases were then made regardless of cover types, so as to obtain a uniform distribution. Due to the craggy terrain on the Cumberland area, release sites were chosen at random in areas of dense cover. Releases in 1958 were conducted at the same farms but sites were selected with care and fields of small grain (wheat, rye, oats, barley), grass and/or legumes were used when possible.

Releases were discontinued on the Jessamine, Kleber and Fort Campbell areas after the initial release and were discontinued on the Bourbon, Owensboro and Saloma areas after two annual releases. The primary factors influencing these decisions were the high mortality rate and/or the lack of available personnel to effectively conduct field activities.

A portion of the Saloma and Cumberland areas was closed to hunting. Hunting was permitted on the other areas at the landowners discretion.

## ACTIVITIES

### *Releases of Coturnix on Study Areas Prior to the Project*

Releases of pen-reared coturnix quail were begun in April 1957, prior to documentary approval of the project. This was deemed necessary as large numbers of birds were being lost at the State Game Farm because of cannibalism and injuries caused from flying into the wire of the holding pens. These releases were handled by project personnel in the same manner as those that followed and are included in the release data.

### *Releases*

A total of 24,147 (11,980 cocks, 12,155 hens, 12 sex?) pen-reared coturnix quail was liberated at the release areas during the study. Data regarding numbers released, sex ratios, and colors of neck tags are listed in Table I. Nine release areas were utilized in 1957, however, three of the minor areas (Jessamine, Kleber, Fort Campbell) were discontinued in 1958 and three other areas (Bourbon, Owensboro, Saloma) were dropped in 1959. Even though releases were discontinued, a limited amount of follow-up work was expended on these areas. Ages of birds released varied from 25 to 48 days with the exception of a total of 1,297 adults liberated on six of the areas.

The over-all sex ratio, excluding twelve birds which were not sexed was .99 cocks to 1 hen.

Releases were made at twenty pre-selected sites on each major area and except for instances where birds died enroute to areas, they were made in groups of 100 birds per site.

All birds were leg banded and with the exception of 201 at Henderson and 199 at the Jessamine County area, were also marked with plastic neck tags for future identifications. A pheasant-type neck tag\*\* was used, although much smaller in size. The tag was  $2\frac{1}{8}$  inches by  $\frac{1}{2}$  inch and a No. 00 safety pin was utilized. Both solid-colored and two-tone combinations were used at the various releases. Different colored tags were used for an area each year. Neck tags were stamped with numbers conforming with the numbers on the leg bands.

All adult coturnix released were culls from the breeder flock at the State Game Farm, and many of them were in poor or only fair condition. Some displayed serious injuries (blind in one eye, lacerations of the skin, etc.) received in battles with pen-mates in the holding pens. The general physical

\*\* Nelson, Lee K., 1955. A Pheasant Neck Tag. Journ. Wildlife Mgt., 19(3): 414-415.

TABLE I

## COTURNIX RELEASES

## BOURBON COUNTY AREA

<i>Year</i>	<i>Cocks</i>	<i>Hens</i>	<i>Sex?</i>	<i>Total</i>	<i>Sex Ratio Cocks/Hen</i>	<i>Neck Tags</i>	<i>Release Dates</i>
1957	980	1,020	-	2,000	.96:1	Blue	July 2-9, 1957
1958	986	1,013	-	1,999	.97:1	Yellow	August 5, 1958
<b>TOTAL</b>	1,966	2,033	-	3,999	.97:1		

## CUMBERLAND AREA

1957	1,089	1,008	-	2,097	1.08:1	White-Yellow Blue-Pink	June 16-Nov. 1, 1957 April 16, 1958 June 25-July 23-28
1958	961	1,038	-	1,999	.93:1	Pink	August 19, 1958
1959	489	509	-	998	.96:1	Blue	July 28, 1959
<b>TOTAL</b>	2,539	2,555	-	5,094	.99:1		

## FORT CAMPBELL

1957	44	56	-	100	.79:1	Red	June 25, 1957
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## HENDERSON AREA

1957	1,110	1,077	6	2,193	1.03:1	None (201) Yellow	April 11, 1957 June 4-7-11, 1957 June 17-July 15-29
1958	919	1,076	-	1,995	.85:1	White	August 12, 1958
1959	483	509	-	992	.95:1	Pink	July 15, 1959
<b>TOTAL</b>	2,512	2,662	6	5,180	.94:1		

## JESSAMINE COUNTY AREA

1957	119	80	-	199	1.49:1	None	April 19, 1957
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## KLEBER AREA

1957	41	16	-	57	2.56:1	Red-Blue	May 2, 1957
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## OWENSBORO AREA

1957	155	145	-	300	1.07:1	Yellow-Red Pink-Blue	June 11, 1957 April 16, 1958
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## SALOMA AREA

1957	1,141	1,107	1	2,249	1.03:1	White White or Pink Red	April 18, 1957 Sept. 27, Oct. 11/57 April 16, 1958 July 1-22, 1958 Aug. 18, 1958
1958	983	988	-	1,971	.99:1	Blue	
<b>TOTAL</b>	2,124	2,095	1	4,220	1.01:1		

## TODD COUNTY AREA

1957	971	1,024	4	1,999	.95:1	Red	June 18-25, 1957
1958	1,015	985	-	2,000	1.03:1	Green	June 17-July 15-29 August 12, 1958
1959	494	504	1	999	.98:1	Yellow	July 1, 1959
<b>TOTAL</b>	2,480	2,513	5	4,998	.99:1		

condition of most juvenile birds appeared to be good. However, their ability to withstand the rigors of the new environment and to take the abrupt change from heated brooder houses to conditions found in the "wild" was questioned. This is a problem that haunts all such investigations which utilize unconditioned pen-reared stock.

### *Field Observations*

As time and personnel permitted, an intensive systematic post-release search was begun immediately after liberation in an effort to secure data on mortality, reproduction and dispersal. Follow-up activities included field work by the grid method and by "beating the brush" in areas of suitable cover near the release sites. Bird dogs were also used intensively for a period in 1957 and 1958. Listening for calls by cocks was a particularly valuable technique in locating birds. In many cases the male was found to be accompanied by a hen. After the first flush it appeared that coturnix were much more reluctant to take wing on reflush attempts. It was noted at some sites that dispersal from the area apparently began immediately. In some instances no birds were found on the first post-release day. At other sites the number of observations gradually decreased over a period of a few weeks. A few cover types such as standing grain, grain-stubble and certain types of hay fields retained birds until late fall. Fields of standing grain and grain-stubble were particularly effective in this respect. Other plant species which appeared to retard dispersal were red-top (*Agrostis sp.*), common ragweed (*Ambrosia artemisiifolia*), Korean lespedeza (*Lespedeza stipulacea*) and alfalfa (*Medicago sativa*).

Many factors were involved in the decrease in the number of birds observed on succeeding post-release days. The high initial mortality rate, commonly associated with released unconditioned pen-reared birds, was one. The dense cover found on some areas seriously hampered observations. It was possible that some birds ran ahead of personnel or held tight and therefore were not seen. Probably the most important factor was dispersal. As birds moved from the release sites the possibility of flushing them gradually diminished to a point where all data on observations were negative after November. The degree of scattering was demonstrated by failure to find birds near release sites and long-range band returns showed the great distances traveled by some birds in their movement from the area.

A total of 1,257 coturnix observations (165 cocks, 146 hens, 946 sex?) by project personnel was recorded during the project tenure (Table II). The major portion of the observations was made within a few days after release. It appeared that dispersal from the immediate vicinity of the release site was very great during the first 48 hours. In only two instances were coturnix observed on the areas during the spring following releases made the previous season.

### *Miscellaneous Observations*

Neck tags were identified in 1,100 (88%) of 1,257 observations. Four additional tags were observed but the color was not identified. Tags were missing in 48 observations and in 79 instances tags were not observed, but may have been present.

Many of the hens had begun laying at the time of the releases and dropped eggs were found during follow-up work at all the areas except Kleber and Owensboro.

### *Cock Call Counts*

In order to obtain data on the frequency of cock calls, counts were conducted on the Owensboro, Henderson and Cumberland areas. On July 29 at the Owensboro area, 94 cock calls were heard in a thirty-eight minute period between 11:18 a. m. and 11:56 a. m. One cock called twenty-eight times during a twenty-six minute period on July 30. The calls were made at irregular intervals, one or two a minute, with periods of silence up to three minutes. During a count which started at sunrise on August 3, forty-two calls were recorded in a ten-minute period. At an afternoon count at the same station only sixteen calls were heard in ten minutes. No cock calls were heard on the Cumberland area, although numerous counts were conducted at various release sites.

### *Mortality*

The total known mortality was 1,466 birds. This was 6.1% of the total number released. Included were 688 cocks and 657 hens and the sex was not determined in 121 cases (Table III). Most of the recoveries resulted from intensive searches at the release sites immediately following liberations. Others

TABLE II

COTURNIX OBSERVATIONS  
BOURBON COUNTY AREA

Year	Cocks	Hens	Sex?	Tag Identified	Tag Not Identified	Tag Not Observed	Tag Missing	Total
1957	--	--	15	4	--	11	--	15
1958	--	--	1	--	--	1	--	1
TOTAL	--	--	16	4	--	12	--	16

## CUMBERLAND AREA

1957	39	30	153	208	--	12	2	222
1958	28	37	47	105	--	2	5	112
1959	6	8	1	15	--	--	--	15
TOTAL	73	75	201	328	--	14	7	349

## HENDERSON AREA

1957	21	11	61	70	--	3	20*	93
1958	27	34	283	326	2	3	13	344
1959	2	--	45	42	--	4	1	47
TOTAL	50	45	389	438	2	10	34	484

## JESSAMINE COUNTY AREA

1957	6	3	1	Tags not used			--	10
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## KLEBER AREA

1957	8	6	12	25	--	1	--	26
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## OWENSBORO AREA

1957	11	--	38	26	1	20	2	49
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## SALOMA AREA

1957	4	5	25	33	--	--	1	34
1958	--	--	91	83	1	6	1	91
TOTAL	4	5	116	116	1	6	2	125

## TODD COUNTY AREA

1957	4	4	45	33	--	12	3	53
1958	7	6	119	120	--	1	--	132
1959	2	2	9	10	--	3	--	13
TOTAL	13	12	173	163	--	16	3	198†
GR. TOTAL	165	146	946	1,100	4	79	48	1,257‡

\* Tags not used at one release site.

† Identification of tag not reported in 16 instances.

‡ Includes a total of 30 untagged juvenile coturnix.

were found by landowners, etc., and were reported to project personnel. A 60-day fall hunting season was open for this bird each year of the project and 113 were known to have been shot by hunters, both in and out of the state.

Intensive searches indicated that the initial mortality may have been quite high, as is commonly the case with some pen-reared stock. It was believed that the majority of the initial losses occurred within the first 24 hours. The known mortality, undoubtedly, would have been much greater if more ground in the vicinity of the release sites could have been searched immediately after liberation. Lack of sufficient personnel and the oftentimes extremely limited amount of the carcass remaining seriously handicapped the recovery of dead birds.

TABLE III  
COTURNIX MORTALITIES  
BOURBON COUNTY AREA

Year	Cocks	Hens	Sex?	Total	Band and Tag Recov.	Tag Only Recov- ered	Band Only Recov- ered	Neither Band nor Tag Recov.	No. Found by Others
1957	74	53	2	129	9	112	6	2	79
1958	33	27	--	60	9	50	--	1	60
1959	--	1	--	1	1	--	--	--	1
TOTAL	107	81	2	190	19	162	6	3	140

CUMBERLAND AREA

1957	99	90	7	196	106	80	3	7	85
1958	69	71	10	150	49	85	6	10	72
1959	13	13	1	27	4	22	--	1	9
TOTAL	181	174	18	373	159	187	9	18	166

FORT CAMPBELL

1957	1	1	--	2	1	1	--	--	2
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HENDERSON COUNTY AREA

1957	35	29	22	86	10	38	17	21	15
1958	68	69	16	153	59	77	1	16	44
1959	25	37	17	79	11	52	1	15	34
TOTAL	128	135	55	318	80	167	19	52	93

JESSAMINE COUNTY

1957	3	2	8	13	Tags not used		5	8	--
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KLEBER AREA

1957	6	3	3	12	1	7	1	3	2
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OWENSBORO AREA

1957	6	4	3	13	1	8	1	3	1
1958	5	9	--	14	--	14	--	--	5
TOTAL	11	13	3	27	1	22	1	3	6

SALOMA AREA

1957	96	90	9	195	52	131	4	8	92
1958	62	62	--	124	38	84	2	--	84
TOTAL	158	152	9	319	90	215	6	8	176

TODD COUNTY AREA

1957	32	35	8	75	19	47	1	8	73
1958	50	49	7	106	27	69	4	6	31
1959	11	12	8	31	5	17	1	8	17
TOTAL	93	96	23	212	51	133	6	22	121

GRAND TOTAL	688	657	121	1,466	402	894	53	117	708
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At releases where only bands were used (Henderson—one site, Jessamine) less than 50% of the mortalities found were identified. However, where neck tags were also used, 94% of the known mortality was identified. In all, 1,296 neck tags and 455 leg bands were recovered. The colored neck tags made the birds more readily observable to field personnel. It was possible that these marking devices made the birds more readily observable to predators, but it was not known what effect they had on predation.

The known losses by area were:

<i>Area</i>	<i>No. Mortalities</i>	<i>Percent of Number Released</i>
Bourbon .....	190	4.8%
Cumberland .....	373	7.3%
Fort Campbell .....	2	2.0%
Henderson .....	318	6.1%
Jessamine .....	13	6.5%
Kleber .....	12	21.1%
Owensboro .....	27	9.0%
Saloma .....	319	7.6%
Todd .....	212	4.2%

The known mortality sex ratio was 1.04 cocks:1 hen compared with a release sex ratio of .99 cocks per hen, indicating little difference in the mortality rates of the two sexes.

Approximately 30% of the known mortality was attributed to predation (Table IV). Mammalian predators were determined to account for 285 and bird predators 55. Predation was indicated in 97 other cases, but the type of animal involved was not determined. A search beneath prominent trees near release sites usually yielded evidence of avian predation. Remains and tags were also found on fence posts. Several coturnix on the Henderson area were apparently killed by a large mammal (possibly domestic), and in at least three instances the carcasses were buried intact. Dissection of these birds revealed that teeth had perforated most of the body. One landowner on the Bourbon County area recovered twenty-two tags from birds, reportedly killed by cats. This was 22% of the number liberated at this particular site.

Drownings and machinery were the causes of at least 44 of the known fatalities.

In 101 cases, carcasses were found intact and no evidence was found to indicate that they had been harmed by another animal. In many of these cases it was believed that exposure to the elements of the wild was too great and the birds became weak and finally died.

In 771 cases, it was not possible to determine from the remains what caused the bird to die, but it was expected that many of the known causes were also involved here.

#### *Dispersal and Hunter-Kill Data*

In general, the known coturnix movement from the releases was in a southerly direction. Recoveries were made in Alabama (6), Arkansas (4), Florida (2), Indiana (2), Illinois (1), Kentucky (58), Louisiana (1), Maryland (1), Michigan (1), Mississippi (7), Missouri (1), North Carolina (2), South Carolina (2) and Tennessee (25) with the major portion (51%) being found in Kentucky. See Table V and Graph I for dispersal data of the various releases. Thirty-three birds were killed on the areas and the remainder were killed at distances up to 710 airline miles (Louisiana) from the point of liberation. There was a time lapse up to 17½ months.

In an attempt to retard dispersal, three feeders, baited with chicken scratch feed, were used at one site on the Cumberland area during 1957 with no apparent effect. The feed was not utilized by coturnix. In 1959 a pen was erected and six birds were held in captivity for a period of four days. The pen was so constructed that food (laying mash and scratch feed) and water were available to the liberated birds as well as to those confined. During this period, from one to six liberated birds were observed feeding daily by the landowner or by project personnel.

A coturnix cock released at one site on the Cumberland area on July 16, 1957, was shot December 2 at Anderson, South Carolina. A portion of the right leg of this bird had been severed but the injury had healed.

In three instances coturnix were killed from coveys of Bobwhite quail but it was not known if these birds had joined the coveys or by coincidence happened to be in the immediate vicinity. One of these recoveries was made in the vicinity of a Tennessee coturnix release.

TABLE IV  
CAUSES OF MORTALITIES  
BOURBON COUNTY AREA

Year	Predation			Died	Drowned	Car	Mower	Com- bine	Disk	Baler	Shot	Total
	Un- known	Mam- mal	Bird									
1957	77	24	--	14	4	--	4	1	--	--	5	129
1958	48	2	--	--	--	--	2	--	--	1	7	60
1959	--	--	--	--	--	--	--	--	--	--	1	1
<b>TOTAL</b>	125	26	--	14	4	--	4	3	--	1	13	190

CUMBERLAND AREA

1957	80	28	1	16	54	12	1	--	--	--	4	196
1958	63	41	2	10	15	--	1	--	--	--	18	150
1959	7	8	7	--	1	--	1	1	--	--	2	27
<b>TOTAL</b>	150	77	10	26	70	12	3	1	--	--	24	373

FORT CAMPBELL

1957	--	--	--	--	--	--	2	--	--	--	--	2
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HENDERSON AREA

1957	49	11	6	10	4	--	1	3	--	--	2	86
1958	70	23	10	25	8	--	--	1	--	--	16	153
1959	22	32	15	--	--	--	--	--	--	--	10	79
<b>TOTAL</b>	141	66	31	35	12	--	1	4	--	--	28	318

JESSAMINE COUNTY AREA

1957	--	2	--	9	2	--	--	--	--	--	--	13
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KLEBER AREA

1957	5	2	1	4	--	--	--	--	--	--	--	12
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OWENSBORO AREA

1957	9	4	--	--	--	--	--	--	--	--	--	13
1958	14	--	--	--	--	--	--	--	--	--	--	14
<b>TOTAL</b>	23	4	--	--	--	--	--	--	--	--	--	27

SALOMA AREA

1957	106	55	7	9	4	1	1	--	--	2	10	195
1958	84	11	4	--	9	--	--	1	--	--	15	124
<b>TOTAL</b>	190	66	11	9	13	1	1	1	--	2	25	319

TODD COUNTY AREA

1957	49	6	1	--	--	--	--	7	--	--	12	75
1958	84	12	--	--	--	--	1	--	--	--	9	106
1959	4	24	1	--	--	--	--	--	--	--	2	31
<b>TOTAL</b>	137	42	2	--	--	--	1	--	7	--	23	212

GRAND

<b>TOTAL</b>	771	285	55	97	101	13	12	9	7	2	1	113	1,466
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A cock released in July 1958 was shot in Alabama in December 1959. This was a movement of  $300 \pm$  miles over a period of  $17\frac{1}{2}$  months. The longevity of this bird in the wild was the greatest recorded during the study.

A total of eleven coturnix from out-of-state releases was killed by Kentucky hunters. Six of these were from Ohio, two from Tennessee, one from Oklahoma and two from Indiana.



TABLE V  
DISPERSAL AND KILL DATA

Location of Recovery	Area of Origin					Total
	Bourbon	Cumberland	Henderson	Saloma	Todd	
Alabama	2	2	--	1	1	6
Arkansas	1	--	1	1	1	4
Florida	2	--	--	--	--	2
Indiana	--	--	1	1	--	2
Illinois	--	--	1	--	--	1
Kentucky—Off Areas	3	4	6	6	6	25
Kentucky—On Areas	--	10	14	5	4	33*
Louisiana	1	--	--	--	--	1
Maryland	1	--	--	--	--	1
Michigan	1	--	--	--	--	1
Mississippi	2	--	2	2	1	7
Missouri	--	--	--	1	--	1
North Carolina	--	1	--	1	--	2
South Carolina	--	2	--	--	--	2
Tennessee	--	5	3	7	10	25
TOTAL	13	24	28	25	23	113

\* Note—Includes four unmarked birds.

### Reproduction

The full extent of coturnix reproduction in Kentucky was not determined, however, it was known that some reproduction did occur since ten nests and 28 broods were recorded. Since this species possessed the capability of producing fertile eggs when only five weeks old, it was assumed that the major portion of the reproduction that occurred was by young-of-the-year birds, since juveniles dominated the releases.

*Nests:* None of the ten nests were active at the time that they were found and therefore it was necessary to attempt to determine the fate from the evidence that remained. The condition of the shells and the inner membranes† was used to determine if hatching had taken place or not. It was believed that at least 50% of the estimated 60 eggs in known nests had hatched.

*Broods:* A total of 28 coturnix broods, including 117 chicks, was observed by cooperators and project personnel. Size of the broods averaged 4.2 chicks. Estimated hatching dates for broods were calculated utilizing the size of chicks in observations (Table VI). It was noted that most broods hatched in August and September, however, these data may have been misleading since a normal reproduction season was not experienced. Since a majority of released juveniles was believed to have been involved, the date of the release and the age of the birds influenced the results.

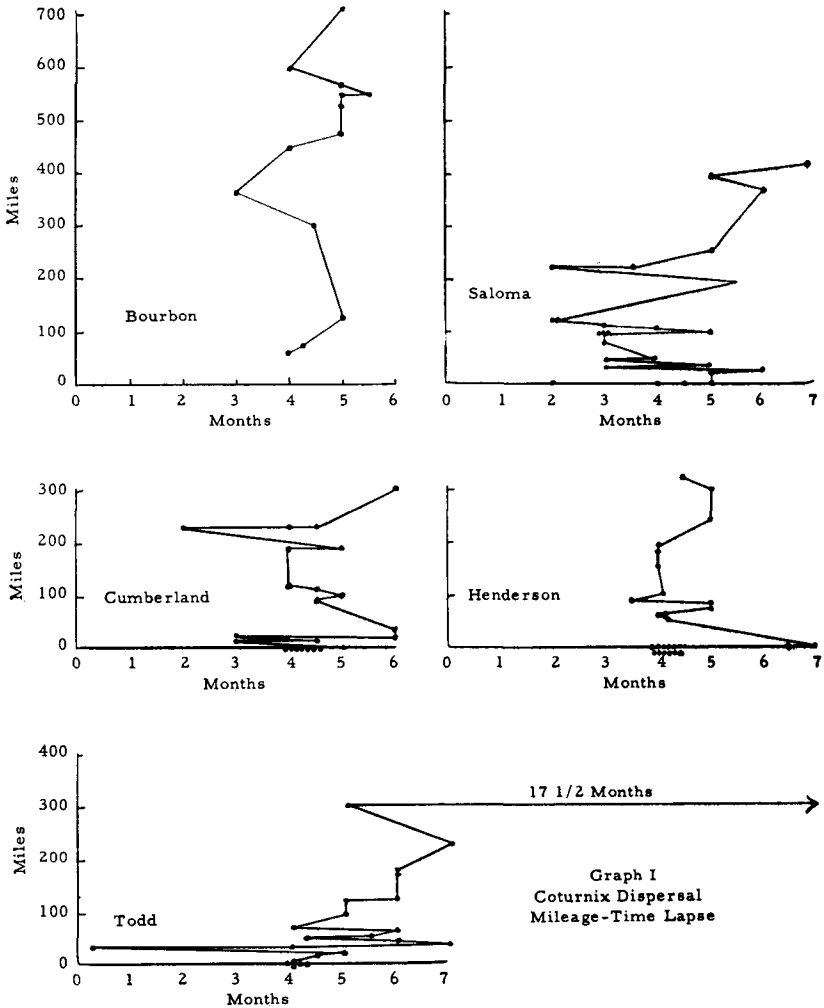
### Effects of Released Pen-reared Coturnix on Bobwhite Quail

The Bunker Hill Island, encompassing approximately 500 acres in Lake Cumberland on the Cumberland coturnix area, was censused prior to coturnix releases as part of an attempt to ascertain the effects of coturnix on the native quail population. Five coveys of Bobwhite, totaling at least 45 birds, were found. See attached map.

A total of 400 pen-reared coturnix was liberated at this site during 1957 and 1958. Two subsequent post-release censuses indicated no changes in the Bobwhite population or any movements from their normal range. These results, though meager, indicated that coturnix releases apparently did not adversely affect native Bobwhite populations.

No detrimental effects to native quail populations were noted during this study. In fact, in three instances hunters reportedly killed coturnix which were found with coveys of Bobwhite. It was not determined, however, exactly what degree of compatibility actually exists between the two species.

† Strode, Don H. 1941. The 1940 Pheasant Nesting Study in Wood County, Ohio. Release 157. Ohio Wildlife Research Station. Page 6.



Graph I  
Coturnix Dispersal  
Mileage-Time Lapse

TABLE VI  
HATCHING DISTRIBUTION OF KNOWN BROODS

Month	No. Broods	Total Chicks
May	1	3
June	1	4
July	3	9
August	10	34
September	10	59
October	3	8

### Live Trapping

On August 13, 1957, a live-trapping operation was inaugurated with the installation of two standard Bobwhite traps in a 12-acre field on the Owensboro area. Two additional traps were set on August 31. A commercial chicken scratch feed was used as bait. It was believed that this field supported the highest population of coturnix for the longest period of time encountered during

BUNKER HILL ISLAND  
 Pulaski Co.  
 Cumberland Area

R1 - Release #1 - 200 Coturnix  
 November 1, 1957

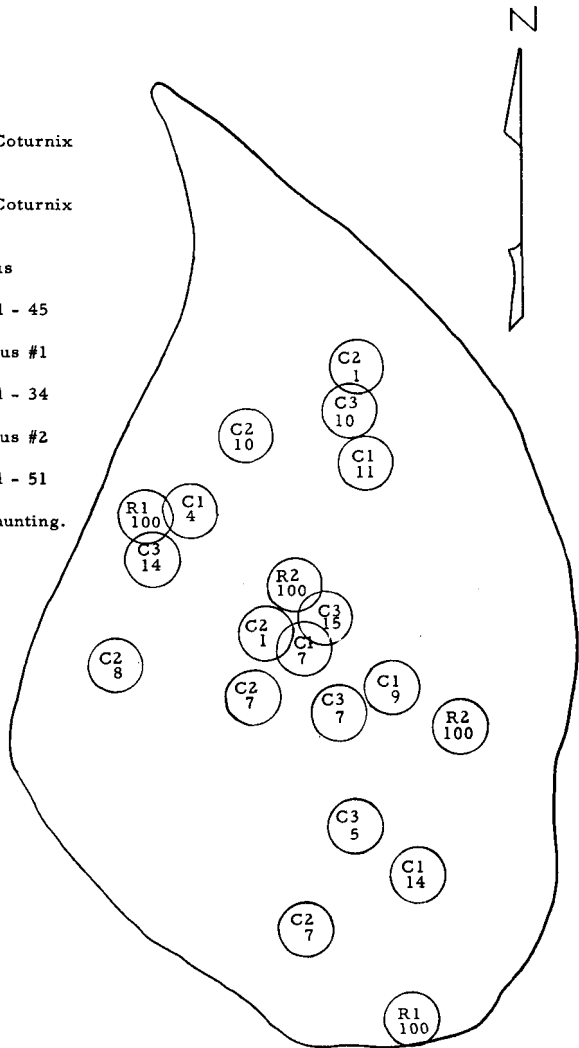
R2 - Release #2 - 200 Coturnix  
 July 24, 1958

C1 - Pre-release census  
 October 1957  
 Bobwhite observed - 45

C2 - Post-release census #1  
 January 1958  
 Bobwhite observed - 34

C3 - Post-release census #2  
 October 1958  
 Bobwhite observed - 51

This area is closed to hunting.



the study. The cover consisted of ragweed, wheat and Korean lespedeza. Although some birds remained in the field until at least November, 1957, none were caught during a total of 82 trap-days. The trapping operation was terminated September 25, 1957.

### SUMMARY AND CONCLUSIONS

A thirty-eight month study of the survival rates and influencing factors affecting released pen-reared Japanese coturnix quail indicated that a permanent establishment of this subspecies in Kentucky was not possible. Future introductions are not recommended.

Releases totaling 24,147 birds were made in a variety of habitat types throughout the State over a period of three years. A limited amount of reproduction was known to have occurred but no birds were known to be residing in the State at the termination of the study.

Several important factors affected the survival of this species. Although the

known mortality was only 6.1% of the total number released, the actual mortality in Kentucky was believed to be much greater. It would have required a small army of field personnel to adequately conduct an intensive mortality search on the study areas alone. It was conceivable that many of the birds left the immediate vicinity of the release sites very soon after liberation and died elsewhere. Mammal and bird predation were factors of considerable importance, but they were not believed to be the primary causes of failure to establish. Rather high initial losses appear to be inherent in stocking programs where unconditioned pen-reared stock are involved. Attractive habitat to the species appeared to be lacking in many cases, as evidenced by almost immediate dispersal from some sites. On the other hand, certain standing grain fields, grain-stubble fields, and some dense hay fields involving combinations of wheat, oats, rye, barley, Korean lespedeza, alfalfa, red top, fescue, and ragweed held some birds from the release date in the summer until late in the fall.

Since this was a migratory subspecies in its native habitat it was reasonable to expect it to move south in the fall. This it apparently did as revealed by a number of band returns from birds shot in states to the south. By late November and December it was almost impossible to find a bird residing on the study areas. However, a true migration did not materialize since no evidence was found to indicate that the birds returned in the spring in reasonable numbers. Only two birds were observed in the spring following releases the previous summer. One, observed by project personnel, had no visible identification marker and its origin was unknown. It could have come from another state making a spring release. The other bird reportedly carried a colored neck tag and was assumed, if the observation was authentic, to have been a bird released by this project.

Birds dispersing from Kentucky apparently did not take hold elsewhere as no establishment of this subspecies is known anywhere in the United States.

Values rendered by this study are summarized as follows:

1. Facts regarding Japanese coturnix survival in Kentucky were obtained which can be used to counter pressures for continued stocking in the future.
2. Additional knowledge regarding the life history of this exotic was acquired.
3. A large savings of Department monies was realized by confining coturnix introductions to a research project where relatively small numbers of release stock were involved and intensive follow-up studies were conducted.
4. Methods and techniques used may provide a pattern useful to the design of a future study of this nature.

## **EVALUATION OF MANAGEMENT TECHNIQUES BY MEANS OF A THREE-YEAR QUAIL CENSUS**

By ELLIS A. CARTER

### INTRODUCTION

The John A. Kleber Wildlife Management Area in Owen County, Kentucky was purchased with funds from a donor for whom the Area is named. The Area, which was first mapped in 1954, comprises 678 acres of rolling hills, and is rather rough and rocky, not more than 10% of the total acreage being suitable for cultivation, and even this is not fertile land. Fringe areas and steep hillsides are wooded, primarily oak and cedar, and brush and undergrowth are prevalent in many sections.

It was specified by the donor that the Area be set aside as a controlled Management Area for wildlife, and hunting has not been permitted since acquisition of the land in late 1953.

Since 1954, the Department of Fish and Wildlife Resources has made plantings in marginal sections to provide winter food, and natural brush cover has been allowed to flourish to a controlled measure. Small fields are mowed regularly to provide open space with grass cover.