The wintering range of the central population is presumably along the gulf coast from Mississippi to Texas, a region from which we have no wintering specimens. The western bird presumably winters in the southwestern states and western Mexico.

The above analysis suggests a method of determining the breeding range of wintering populations, even though it is hopeless to identify individual specimens. Almost any specimen of catbird can be matched by individuals from any part of the breeding range of the species. It is only by studying adequate samples of migrating or wintering populations that one can determine what their breeding area was.—*Chicago Natural History Museum, Chicago, Illinois, July 22, 1948.*

RED BOB-WHITE—A REPORT AND CORRECTION

BY LEON J. COLE, HERBERT L. STODDARD AND E. V. KOMAREK

IT is a curious fact that among the earliest bob-whites described was one exemplifying the rare red phase of the species, which even today is known from relatively few specimens. The original habitat was given as "South America; locality unknown," but Gould (1843) recognized its closeness to *Colinus virginianus*, and whereas he described it as a distinct species, which he called *Ortyx castanea*, it has been generally considered an aberrant form of *virginianus*. Aldrich (1946: 497) goes so far, on the basis of measurements, as to put it in the subspecies *marilandicus*, and suggested Boston, Massachusetts, as a suitable type locality.

In his 'Monograph of the Odontophorinae' (1850), Gould republished his original description of this bird, adding a few remarks and a colored plate. Gould had only the one specimen which he obtained from the collection of the Zoological Gardens at Manchester, and which he showed in two positions. It is of interest to us because, in addition to the general rich chestnut coloring of the body, the forehead and throat of the type are black, while the under sides have more black than *virginianus*. The crop patch found in most of the red birds appears to be absent.

No special mention appears to have been made of this red quail for some time, though it would be surprising if it had not been taken by hunters from time to time. E. W. Nelson was especially interested in them, and Aldrich (1946) gives a few early records from various parts of the country, all of which fall, however, within the range which he ascribes to the subspecies *mexicanus* and *marilandicus*—that is, the northern part of the specific range of *C. virginianus*. The earliest

record is of an adult bird taken by M. W. Greenwood at Bethel, Ohio, in 1874, which is now mounted in the Curier Press Club collection of the Cincinnati Society of Natural History. Following that, there is a long gap to January 15, 1921, when an adult female, now in the U. S. National Museum, was taken by H. T. Gouldman in southern King George County, Virginia, and two specimens were shot by H. Mackay, January 24, 1933, on his game preserve in Guilford County, North Carolina.

Attention was brought to the red quail by the considerable numbers which occurred in the succeeding years on the Hobart Ames Plantation at Grand Junction, Tennessee. According to C. E. Buckle (1927), at that time manager of the Ames Plantation, these birds were first noticed in 1925, for he says: "We have known for two years that there were several red birds in this bevy." Apparently the birds came to the attention of E. W. Nelson in the fall of 1926, for he notes in a manuscript that there were at that time "six or seven in a covey of about 15 to 20 birds" (Aldrich, 1946). Buckle sent the same information to the Cooperative Quail Investigation (Stoddard, *in litt.* Feb. 17, 1927). In the April, 1927, issue of 'American Field,' Buckle published a brief but very excellent account of the Ames birds up to that time. In succeeding years the red quail increased and spread, so that Stoddard (1931) reported that "no less than one to five have been noted in seven different coveys, distributed over several square miles, some of them being fully four miles from where the variation was first noted." Dr. Herbert Friedmann, of the U. S. National Museum, early became interested in the problems presented by the Ames birds and coöperated in many ways in initiating our studies and experiments.

One of the early specimens taken by Mr. Ames is depicted by Stoddard in his colored plate (1931: 18). From the genetic standpoint, the red coloration was of particular interest, for if it should prove upon breeding to behave as a sex-linked character it could possibly be comparable to the red coloration in pigeons which Cole and Kelly (1919) had attributed to what they called the A-factor. This was taken up with Mr. Ames, who gave a half-dozen of the red birds with which to make the test in 1930. The experiment was carried on with the coöperation of the Poultry Department at Madison, Wisconsin, and the breeding experiments were conducted by M. O. North, under the general direction of L. J. Cole. Due to inexperience with bob-whites and to various misfortunes, meager data were obtained, and the experiment was terminated by rats. The results, as far as they went, seemed to favor the interpretation of the character as sex-linked, and this was reported briefly and tentatively (Cole and North, 1931). What ap-

peared to be the critical mating was of normal male to red female, from which eleven chicks were obtained; the four red ones were males and the seven normal ones, females. The sex of one red and two normal chicks could not be determined. Only two eggs were fertile in a reciprocal cross (red male and normal female), and two normally colored chicks were obtained. Sex of these chicks could not be determined, but they indicated, at least, that the male was heterozygous.

TABLE 1

LIST OF MATINGS MADE IN STUDY OF INHERITANCE IN RED QUAIL

	Experiment	*Male*	*Female*	*Eggs*	*Infertile or died in egg*	*Color* *Red*	*Color* *Intermed.*	*Color* *Normal*
1934	A	Red (H. Ames-963)	Red (H. Ames-953)	57	13	44		
1934	B	Red (H. Ames-851)	Normal	74	6		68	
1934	C	Normal (L. S. T. 32-1251)	Red (H. Ames-893)	52	5		47	
1935	D_1	Red (from A)	Inter. (from C)	25	8	6	7	1
1935	D_2	Red (from A)	Inter. (from B)	35	8	19	2	
1935	E	Inter. (from B)	Normal	71	8	14	11	15
1935	F	Inter. (from B)	Inter. (from C)	86	44	26	2	8
1935	G	Inter. (from B)	Inter. (from B)	60	33	16	5	4
1935	H	Inter. (from C)	Inter. (from C)	51	26	9	6	5
1936	I	Normal (from E)	Normal (from E)	41	16			25
1936	J	Inter. (from E)	Inter. (from E)	28	15	3	5	5
1936	K	Normal (from E)	Normal (from E)	37	37			
1936	L	Red (from A)	Inter. (from C)	54	14	11	29	
1936	M	Inter. (from E)	Inter. (from B)	23	2	6	11	4

It was obvious that these experiments needed to be repeated and extended before any definite conclusions could be made. Accordingly the experiment was set up with headquarters at Sherwood Plantation, near Thomasville, Georgia, as mentioned in the report of the Coöperative Quail Study Association (Stoddard, 1935: 18). The data were assembled principally by Komarek with supervision by Stoddard. It was soon found that there was a high correlation between the coloration of the chick and that of the adult, so the numbers which could be recorded were much greater than before, and over a hundred skins were saved for later reference. The experiments set up in 1936 were consistent and unequivocal in showing that the assumption of sex-linkage was wrong, but they were continued two more seasons to get further results. Finally, the three authors have had opportunity to go over the accumulated records and specimens together.

The results of the first year showed that the four birds received from Mr. Ames were all homozygous (Table 1). When mated together, 963 and 953 (Experiment A) produced a relatively uniform lot, distinguishable from the heterozygous chicks in B and C (Plate 2). The young of A were all of a deep chocolate red, usually more dusky on the

throat, while the downy young of B and C had a warmer cast and a wren-like or grizzly appearance due to indistinct barring. On the whole the birds of C seemed a shade lighter than those of B, but this did not hold for individual comparisons.

TABLE 2

MATINGS GROUPED ACCORDING TO ASSUMED GENOTYPES INVOLVED

Group	*Genotype*	*Homozygous dominant*	*Heterozygous*	*Homozygous recessive*
a	A (RR x RR)	44 (16 ♂ : 18 ♀) (44)		
b	D-1	6 (3 ♂ : 2 ♀)	7 (2 ♂ : 4 ♀)	1[1] (1 ♀)
	D-2	19 (1 ♂)	2	
	L	11	29	
	(RR x Rr)	36 (37)	38 (37)	
c	B		68 (13 ♂ : 14 ♀)	
	C		47 (16 ♂ : 16 ♀)	
	(RR x rr)		115 (115)	
d	F	26[2] (2 ♂ : 2 ♀)	2	8 (2 ♀)
	G	16[2] (4 ♂)	5 (3 ♀)	4 (1 ♂)
	H	9 (4 ♂ : 1 ♀)	6 (2 ♂ : 3 ♀)	5 (1 ♂ : 1 ♀)
	J	3	5	5
	M	6	11	4
	(Rr x Rr)	60 (28.75)	29 (57.5)	26 (28.75)
e	E (Rr x rr)	14[1] (1 ♂ : 1 ♀)	11 (2 ♂ : 3 ♀) (20)	15 (3 ♂ : 2 ♀) (20)
f	I (rr x rr)			25 (25)

[1] None expected in class.

[2] Many of the birds in this class obviously belong in the heterozygotes, but it was impossible to make phenotypic classification.

Stoddard (1931: 87) has called special attention to the albinistic spots which accompany this erythrism in the bob-white, and to the similar markings in Cory's least bittern, which is undoubtedly a comparable red color phase of the least bittern (*Ixobrychus exilis*). The white spots show in the down as well as in the white feathers that mature later in the same areas. These crop patches, as they were called from their position, while variable in size involving from three or four feathers to as many as 20, were nearly always associated with the gene for red. The size of the spots seemed to vary independently of whether the bird was homozygous for red or heterozygous, and more rarely the spot was entirely lacking, at least in the adult bird. These crop patches, however, do not occur in birds recessive for this factor.

When the homozygous red is mated with the intermediate (b, Table 2), equal numbers of the two classes are expected. That they came so close is probably due to chance rather than to accuracy of classification. The one recorded as recessive does not belong in this class and is probably an error of some sort.

In the class (d) which should give one-quarter recessive, on the assumption that we are dealing with a simple case, the actual number recorded is remarkably close. In the other classes, however, the numbers should be just about reversed from what they are. It is obvious that too many are recorded as homozygous red when they should be heterozygous. In some cases these were separated into darker red and lighter red, showing variability, but they were necessarily described under different conditions, and therefore a reliable classification was impossible.

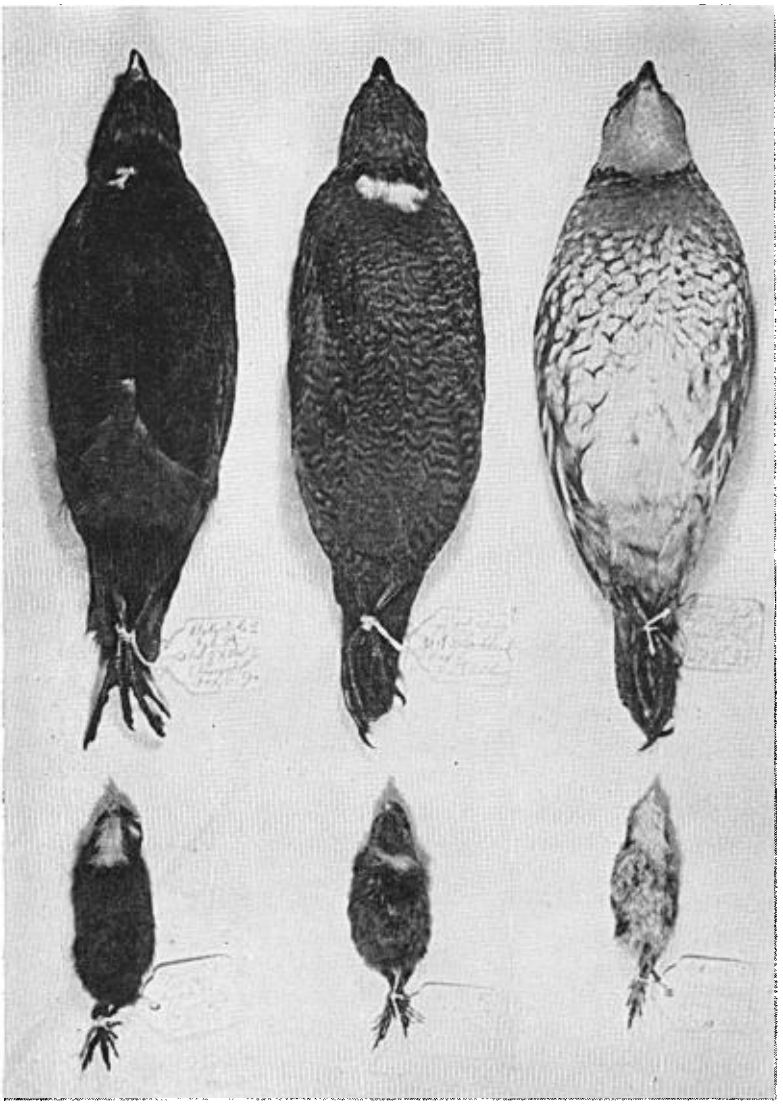
For the same reason it is possible that all the red chicks in the next experiment (e) were intermediate and that they were recorded as dark red because exact discrimination was not practiced at this stage of the investigation. All the skins saved of both young and adults proved, when examined later, to be of the intermediate class.

The recessive is easy to distinguish, and in Experiment 1 (group f) all the young were normal in spite of the fact that they had an intermediate grandparent.

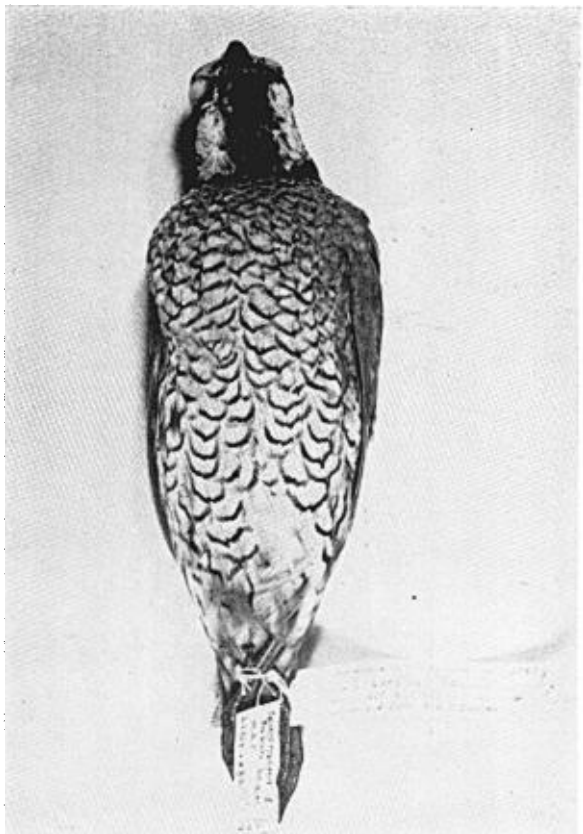
Stoddard (1931) lists a number of variations that are occasionally found in bob-whites, in addition to the differences that distinguish the various subspecies from one extreme of range to the other. One of the commonest of these is a tendency towards albinism, which occurs in a good many individuals, and has led to reports of "white" coveys of bob-whites. There is a color phase of the Japanese quail (*Coturnix coturnix japonica*) which has long been bred (Shimakura, 1940). It is known as "brown-splashed white" and is commonly smaller, less active, and less fertile than the normal. Constantly, the "splashed" behaved always as homozygous for a single Mendelian, autosomal, recessive gene.

We have notes made a good many years ago of a beautiful bob-white taken in Maryland in 1846, and now in the collection of the U. S. National Museum. This bird appears normal in marking except that there is no black, which is replaced by reddish brown.

The throat of the adult male is normally a shining, clear white, but examples are occasionally found with a saffron tinge, much as in the female (Stoddard, 1931: Pl. 18). This is quite likely associated with some hormonal condition, but what part heredity takes, if any, has not been demonstrated. On the same plate is shown the incursion of



BOB-WHITE QUAIL: BIRDS AT LEFT, BOTH ADULT AND CHICK, ARE HOMOZYGOUS FROM EXPERIMENT A. THE ADULT IS A FEMALE WHICH DIED AT ABOUT 101 DAYS OF AGE ON SEPTEMBER 30, 1934; THE CHICK, A FEMALE, DIED SEPTEMBER 9, 1934, AT FIVE DAYS OF AGE. IN THE MIDDLE IS A HETEROZYGOUS INTERMEDIATE FROM EXPERIMENT B (RED ♂ X NORMAL ♀). IT DIED OF BLACKHEAD, SEPTEMBER 15, 1934, AT 93 DAYS. THE INTERMEDIATE CHICK FROM THE SAME EXPERIMENT WAS FOUR DAYS OLD WHEN IT DIED. THE NORMAL FEMALE AT THE RIGHT WAS TAKEN AT TALL TIMBER PLANTATION, LEON CO., FLORIDA, ON JANUARY 15, 1932. THE NORMAL CHICK IS A MALE PREPARED ON SHERWOOD PLANTATION, JULY 10, 1934.



BLACK-THROATED BOB-WHITE MALE: COLLECTED AT MICHIGAN AGRICULTURAL COLLEGE BY L. J. COLE AND W. B. BARROWS, OCTOBER 16, 1897 (UNIVERSITY OF MICHIGAN MUSEUM OF ZOOLOGY, NO. 1083z).

black into the white throat patch, which is fairly frequent and varies greatly in extent. Covert (1898) mentioned a bird taken at the Agricultural College in Michigan and now in the collections at the University of Michigan, which had an extensive amount of black (Plate 3) on the throat and conspicuous black edgings on the breast and belly feathers, giving a distinctly scaled appearance. It will be recalled that Gould's bird (1850) had an excess of black and was also markedly chestnut. Nothing is known as to the inheritance of this condition, but apparently it may occur independently of the 'red quail.'

DISCUSSION

The 'red quail' condition is apparently an incomplete dominant which has cropped out several times within the more northern part of the range of *Colinus virginianus*, but nowhere, except possibly at Grand Junction, Tennessee, has it shown any tendency to persist. There was an effort there from early times to protect these birds, and this was supplemented by experiments to propagate them. The selection of the darker red birds in this work undoubtedly increased the proportion of homozygotes. We have no evidence that there was any natural tendency for selection on the basis of color. Both at Grand Junction and in Georgia, banded red quail that had been released as adults appeared in a few instances from five to 35 miles away, apparently having the propensity for occasional wandering that is usual in artificially propagated bob-whites. Dr. L. C. Morley of the Biological Survey, in making tests for bacillary white diarrhea, found that the reds bled more easily than the normals; the veins in the wing seemed to stand out more, and the blood spurted much more easily. The birds also appeared weaker than the normal individuals and would struggle less. If there is a negative population pressure working against the reds, they cannot be expected to maintain themselves indefinitely without help.

The adult breeding stock furnished by Mr. Ames for the Wisconsin experiments of 1930 were artificially reared on his plantation at Grand Junction, Tennessee, from adult red quail trapped in the wild on his place. Likewise the birds he furnished for the later experiments in Georgia were from artificially reared stock. In neither case is it known just how the matings were made that produced this foundation stock, though we were informed that the darker reds were selected for breeding stock as a general practice.

In the Georgia experiments, the breeding coops containing the red birds were placed with, and handled uniformly with, a large number of

coops used for the production of normally colored bob-whites that were being propagated for both experimental purposes and for release in the wild. Consequently a direct comparison of the hardiness and disease resistance of the red birds and the normally colored ones was possible. It was found that the reds lacked the vigor of the normal birds, their egg fertility was much lower, and their mortality rate both before and after hatching was much higher. In a letter of May 26, 1936, Hobart Ames stated that in his propagating plant: "We have always had more difficulty raising red quail than ordinary quail."

Two attempts were made to establish the red birds by releasing artificially propagated adults in ideal surroundings on two great quail preserves some 12 miles apart in Leon County, Florida. Four pairs of mated red birds, which had started the production of eggs, and one extra female were released on Sunny Hill Plantation, April 21, 1939, and an equal number (three males and six females) were liberated on Forshala Plantation the next day. In neither case was a 'center' of the red birds established, and only one unbanded red quail from the former appeared in the bag of quail during subsequent seasons to indicate that breeding had been successful. One red pair built a nest and laid several eggs near the release point on Forshala Plantation, but this nest was destroyed by a predator.

Several red quail were likewise liberated, or escaped, on Sherwood Plantation during and after the experiments, but no reds were seen there after a couple of years.

Artificially propagated red quail have been liberated on the Ames Plantation in large numbers, some years as many as three or four hundred, from the beginning of the work there until 1945, without their becoming very numerous in the region or on the plantation. In this connection R. H. Scott, present manager of the plantation, in a letter written on June 9, 1947, states: "Answering your question as to whether the red birds could maintain their numbers on the Plantation without being replenished with the artificially bred red birds, would say that they could not. . . . Up until two years ago, we have turned loose as high as four hundred of these Red Quail a year and we are sorry to say that we were unable to find [more than] very few of them during the shooting season." This, however, does not appear particularly surprising now, as abundant evidence has accumulated that artificially propagated quail seldom establish themselves and thrive after release in the wild. There is every reason to believe that this strikingly beautiful color phase will remain a rarity in the wild in the future, as it has been in the past.

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Department of Genetics, Wisconsin Experiment Station, Madison,
February 18, 1948.

DISTRIBUTION OF THE RACES OF THE SWAMP SPARROW

BY W. EARL GODFREY

SINCE the description of *Melospiza georgiana ericrypta* by Oberholser (1938), the distribution of this subspecies has not been well understood, a state of affairs which is reflected in the vernacular name it has borne, western swamp sparrow. Its breeding range was outlined by Oberholser as "Alberta and Manitoba south to North Dakota" and quoted in the Nineteenth Supplement to the A. O. U. Check-list (1944). First published suspicion of its breeding in the east was that of Aldrich and Nutt (1939) who noted that a small series of breeding birds from Newfoundland was intermediate between *georgiana* and *ericrypta*. Later Peters and Burleigh (1945) definitely referred a more adequate Newfoundland series to *ericrypta*. Earlier, Braund and McCullagh (1940) referred birds from Anticosti Island, Province of Quebec, to *ericrypta* and suggested a probability that this race might be found to have an unbroken breeding distribution east across the northern part of the species' range.

In the course of identifying the swamp sparrows in the National Museum of Canada, the writer has examined 260 specimens of this