

# REVIEW OF LITERATURE ON FACTORS AFFECTING BOBWHITE QUAIL (*COLINUS V. VIRGINIANUS*) POPULATION FLUCTUATIONS<sup>1</sup>

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The cause of the present low in bobwhite quail populations in Ohio is a very controversial subject. Many reasons have been advanced to explain the periodic fluctuations that occur in bobwhite populations in this state. It is the purpose of this paper to discuss and attempt to evaluate these reasons. Of the many articles reviewed by this writer only a selected few have been used as references to avoid repetition and in order to eliminate unsound conclusions.

According to Leopold (1) the history of bobwhite populations in the north central states can be subdivided into four stages.

1. A pre-settlement stage during which it was likely that quail were restricted to the open edges of prairies and open woods.
2. A crude agricultural stage; a period where good interspersion of grain, brush, weeds and hedges made possible the extension of the birds' range and stabilized the population.
3. An intensified agricultural stage which was accompanied by a decrease in quail numbers "frequently due to overshooting, and nearly always due to a decrease in the area of habitable range."
4. A stage of agricultural depression, good roads, and automobiles.

Leopold mentions that the third stage began as early as 1875 in some regions and as late as 1905 in others. Severe fluctuations in bobwhite quail numbers in some areas were evident long before the third and fourth stages were firmly established (2, 3, 4, 5, 6, 7).

Various factors have been ascribed as the major causes of bobwhite population fluctuations—exposure, starvation, drought, predation, inbreeding, migrations, and competition. Reference to severe winters as a cause for the periodic reduction of quail is quite common in the literature (2, 4, 8, 9, 10, 11). Even as early as 1782 De Crevecoeur (8) reported a severe winter that reduced the bobwhite to near extinction in the East. Scott (12) states that:

1. Reasonably healthy Bobwhites may perish through imprisonment by drifting snow.
2. Exposure to cold, high winds and snow may kill reasonably healthy Bobwhites.

It is apparent that the phrase "reasonably healthy Bobwhites" may be applied to birds with avitaminoses of such a slight degree as to be vulnerable to climatic severities and yet not noticeable to the human eye. Leopold (4) also reports "fat well-fed quail as having died in numbers." Trautman's (13) investigations in Ohio indicate that:

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1. An important factor in reducing the bobwhite breeding population in Ohio is the inability of the bird to obtain sufficient food during the stress periods of winter.
2. In every winter some mortality from starvation and exposure occurs.
3. High mortality among bobwhites occurs in freezing weather following severe sleet storms or during heavy snows.
4. The heaviest mortality occurs where clean farming is practiced and cover is deficient.
5. Mortality during very severe storms occurs even on farms where normally cover and food are abundant.

The destructiveness of winter weather is also emphasized by Allen (14) who states:

It seems justifiable to conclude that snow and ice are the most destructive climatic agents to the bobwhite quail on the northern edge of its range. They operate either by cutting off the birds' food supply or by killing them directly when accompanied by strong winds and low temperatures. It is the exceptional years which kill the quail and it has been estimated that such a winter in the north central region can be expected every 4 to 7 years.

The ability of the bobwhite to withstand such environmental hardships as food shortages and exposure is very low as compared with other game species (the quail is classified as a song bird in Ohio), notably the ring-necked pheasant and wild turkey (15). Gerstell (15) stressed covey size as a factor in winter survivability. The bobwhite's ability to withstand lack of food was low as compared with that of other game birds (15). The results of fasting tests show that the maximum survival was less than one week even at high temperatures; at lower temperatures the survivability averaged only several days. In relation to the above Gerstell (15) states:

In this connection it must be remembered that both observations in the field and tests performed in the laboratory have revealed the fact that even under favorable food conditions the bobwhite suffers mortality as a result of exposure to environmental extremes.

During the winter of 1935-36 on an area in Pennsylvania where winter feeding was carried on, high mortality occurred and over 90 per cent of the bobwhite perished (15). Nestler and Langenbach (16) state that extreme temperatures alone may not be the only cause of bobwhite mortality during severe winters. Their results showed that under controlled laboratory conditions no deaths of bobwhite quail occurred during sub-zero temperatures, whereas nearly all mortality during the experiments occurred during or immediately following abnormally heavy and prolonged rain-storms. Errington's (17) field observations apparently confirm these observations:

Native northern bobwhites, if well fed and in prime condition, usually withstand most low temperatures occurring within their range. Many of my field notes deal with populations surviving air temperatures lower than 15° below zero (F.).

Drought in this region appears to be of minor significance in determining the general trend of bobwhite populations, although no definite proof is possessed. Errington (18) reports that if drought is extreme enough, it may cause a possible wholesale loss of eggs, partly because of egg spoilage after premature incubation and partly because of desertion.

The effect of cover on the carrying capacity of a quail range seems to be fairly well established (19). Cover may operate as the limiting factor during severe

fluctuations of bobwhite quail populations in some areas (13). It is entirely possible, too, that a lack of suitable cover may play a role in the effect of severe winters—a stepping stone to severity.

Predatory pressure has often been assigned first place as the explanation of lows in game populations. This is especially true at the present time in Ohio, due to the low number of game species and the high fox population (*Urocyon cinereoargenteus* and *Vulpes fulva*). Errington's (18) observations indicate that predation plays a major role in reducing populations only when the carrying capacity of the range is exceeded. Relatively high bobwhite populations have been maintained in sections of unglaciated Ohio, which also maintain a high fox population; in other sections, portions of glaciated Ohio, where there have been few or no foxes, the bobwhite have been relatively scarce.

Increased numbers of pheasants and Hungarian partridges may have affected the population of native bobwhites. Errington's (20) observations support this view. Although in northwestern Ohio an increase in pheasant populations occurred concurrently with a decline in bobwhite numbers and with a decrease in diversified farming of the land, there appears to be no clear relationship between the pheasant population and the severe decline in bobwhite numbers in that area.

The laymen in Ohio often express the belief that quail at the present time are smaller than in previous years and that this decrease in size and also in numbers is the result of inbreeding. Weight studies conducted by the author (unpublished) and by Trautman (21), on Ohio bobwhite show that the weight of quail in the state varies with locality and that the birds are as large in size in each locality as they were many years ago. Aldrich (22) mentions the possible effect of lowering survivability of native stock by inbreeding with introduced birds foreign to the region. The bobwhite quail in Ohio has been classified as a songbird since 1917. Very few releases of quail have been made since that time. Where releases have been studied they appear to have been unsuccessful (23). The small number of releases and the low survivability of released birds may eliminate the effect of inbreeding with foreign birds. Research by Nestler and Nelson (24) on inbreeding in pen-raised quail indicates:

“that close inbreeding of quail can have deleterious effects on reproduction.”

Relatively high quail populations in various sections of unglaciated Ohio and the occurrence of the “fall shuffle” tend to eliminate the effect of inbreeding in native populations. However, in areas of low populations as in portions of glaciated Ohio, a fall shuffle may not be effective in the prevention of inbreeding. (i.e. the coveys are so far apart that a mixing of coveys do not occur as a result of the fall shuffle). In a region of this type inbreeding over a period of time may therefore reduce reproduction and thus the total population.

The fact that birds of normal weight have been known to freeze despite reports (16, 17) of their tolerance to extremes of temperature under field and laboratory conditions indicates that death by freezing may be due to a change in the normal physiological condition of the birds. This change may be due to a dietary deficiency or the inability of this species to survive near the edge of its northern range. Nestler (25) suggests that a vitamin A deficiency may be a cause of the fluctuation in quail populations on their northern range. A study conducted by the author (26) indicated that a vitamin A deficiency during the winter of 1946-47 in Ohio was not a limiting factor in bobwhite quail populations.

It appears from the preceding discussion that the cause of bobwhite quail population fluctuations in Ohio is unknown. These fluctuations are probably not due to any one factor but are the result of interactions of many factors.

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