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## Quail Hatching and Primary Feather Moulting in Adults

M. E. STEMPEL<sup>1</sup>

*Abstract.* This study was made to determine causes of changes in the young to adult ratio in quail shot by Iowa hunters. A total of 13,206 wings was collected from 1952 to 1959. Age of young and stage of moulting in adults were determined by primary feather development. The hatching period was indicated by the age of young. Early brooding adults were first to mature the flight feathers. Late moulting adults were poor flyers and were easily taken by hunters.

Data on the age of quail (*Colinus virginianus*) shot by Iowa hunters showed that in years of similar production there were differences in the percentage of adult quail. The problem was, "Did the number of adults vary as indicated?"

High hunting success has followed high production. Therefore, it appeared that gunners should take a higher proportion of young after hatching was most successful. Actually, there was considerable variation in the percentage of adults shot by gunners during years when hatching success was similar. Data gathered since 1952 indicate that changes in the proportion of adults may have been due to weather. This is so because suitable weather patterns aided hatching, which was followed by moulting, and moulting determined the flight ability of quail. The best flight was possible for birds that had moulting and completely regrown their primary flight feathers.

The following text is based on information from records of several studies in other states as well as in Iowa. Wing data are presented, first without interpretation, and then they are compared to some production and hunting records. The hunting information is based on observations by the writer and on records kept by acquaintances.

### METHOD

In Iowa, since 1946, wings from birds shot during the hunting seasons have been collected by conservation officers and biologists. Until 1952 wing samples were used only to establish a young to adult ratio as described by Stoddard (1931).

Since 1952 special emphasis has been placed on "dating" the wing samples on which the date of kill was known. With the aid of a

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chart designed by Petrides and Nestler (1943) the wings were classified according to date of hatch. This was done by examining the ten outer primary flight feathers. In adult wings the outer feathers (numbers 9 and 10) have a brown color if they have been retained from the previous year. New feathers have a deep grey tint. Young that had fully developed flight feathers were classed as 150 day olds. Young with growing primaries were aged according to the chart. If, for example, the number eight (third from the outer end) feather was three-fourths grown, the bird was 127 days old. Since most of the samples bore the date when the birds were shot, it was possible to determine the approximate age of each. By back-calculation from the date of kill, the date of hatch was established.

In addition to aging wings of birds of the year, a record was made of the stage of development of the outer two (9 and 10) primary flight feathers of adult quail. These two feathers are the last to be shed. The tips of the new feathers are more blunt than the tips of first year primaries. Moulting stage in the adult reflects the hatching pattern for the season (Thompson and Kabat, 1950; Stempel, 1952). It was presumed that all birds which completed the nesting activity at the same period in the summer would show the same pattern of wing moult. Early moult indicated early brooding and late moult was a result of late nesting.

## RESULTS

A total of 13,206 wings was collected in the past eight years. While over 80 per cent of this sample was composed of wings of young birds, the proportion varied considerably in different years (Table 1).

Table 1  
Quail Wings Collected in Iowa, 1952-1959

Year	Number of Dated Wings	Per Cent of Adults
1952	1,443	13
1953	989	17
1954	2,746	10
1955	2,410	11
1956	1,679	13
1957	1,254	13
1958	1,253	20
1959	1,432	14
Total	13,206	Average 14

Wings were collected from about 650 hunting parties each year. Most of the sample was obtained in 30 counties within or adjacent to the main quail range. Largest contributions came from the territory lying between Chariton and Ottumwa, and south of a line

drawn between the two towns. This is the heart of the quail territory in Iowa.

Within the main range the longest peak hatching periods occurred during years when production was high (Figure 1).

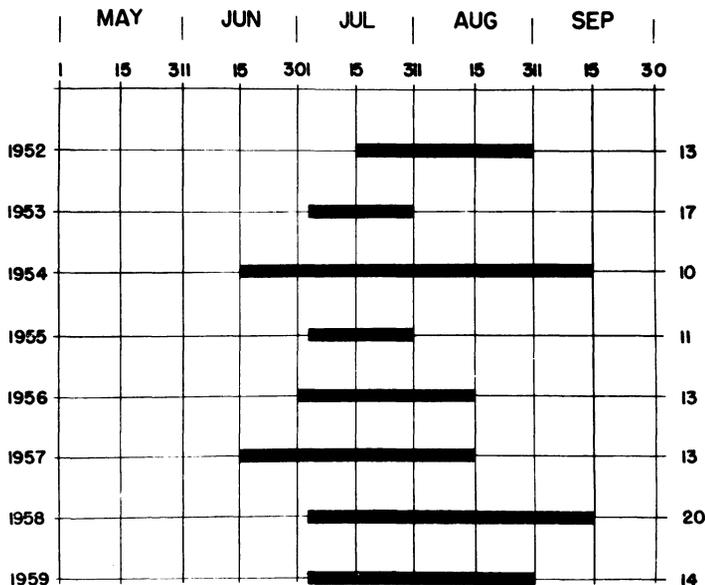


Figure 1. Maximum hatching period of quail, 1952-1959. The heavy lines represent the periods of time during which there was extensive quail hatching. To the right is shown the per cent of adults shot and retrieved by Iowa hunters.

During 1953 and 1955, quail production was low, hunting was poor. In the late summer periods of both years there was unfavorable drouth. On the other hand, 1954 and 1958 brooding seasons were extensive; temperature and moisture were suitable and hatching was prolonged. Exceptionally good hunting resulted. Other years may be classed as reasonably satisfactory.

ATTRIBUTES OF UNSATISFACTORY PRODUCTION AND HUNTING

During the low production seasons of 1953 and 1955, the calling by male bobwhites was at a high point during the first two weeks in June. It diminished rapidly in late July. Hatching, as indicated by data from wings of young, was extensive by late June and was at a low point in late August. The 150-day-old young made up an average of 55 per cent of the bag. Adults composed an average of 15 per cent of the hunter take. Of these, 33 per cent bore matured or nearly matured primary flight feathers.

In 1955, calling by males was well begun by June 1. It fell to

a low point in August. Hatching, as indicated by wing samples, was extensive in early July and fell off rapidly after a sudden decline between July 1 and 15. Sixty-two per cent of the young were 150 days old or older.

Eleven per cent of the hunter bag were adults. Adults that bore mature or nearly mature flight feathers made up 23 per cent of the kill by hunters.

In comparing the data from the 1953 and 1955 seasons, we can see that in 1953 the calling by males was more extensive, and the hatching period was longer. There was a higher percentage of adults, and a higher percentage of adults that had matured, or nearly matured, primary flight feathers. There were fewer 150-day-old quail in the 1953 hunter bag.

#### ATTRIBUTES OF SUCCESSFUL HATCHING AND HUNTING SEASONS

Between 1952 and 1959, the best years for quail production and survival were 1954 and 1958. In 1954 an early sign of brooding was the calling by the cocks. This was well under way by June 1 and continued at a high rate into August. The fall study of wings from quail shot by hunters indicated that hatching was extensively by June 15. Many (55%) of the young were 150 days old or older when shot.

In 1954, adults made up ten per cent of the bag of quail. Of these, 50 per cent had matured or nearly matured primary flight feathers.

In 1958, calling of cock quail was extensive by June 15 and continued into August. Study of the wings from quail shot by hunters indicated that the hatch was progressing well after June 15, and it continued into September. Of the young, 38 per cent were over 150 days old.

Adults composed 20 per cent of the hunters' take. Of these, those with matured or nearly matured primary flight feathers made up 57 per cent.

Although the production of quail was similar in 1954 and 1958, there was a difference in the age ratios in that more of the young were 150 days old in 1954. A smaller percentage of adults was shot in 1954.

Moderately good production and survival occurred during the seasons 1952, 1956, 1957, and 1959. During each of these years the calling by males was at a fairly high level by June 15, and it persisted into August. Hatching began in early June and lasted into September. There was some variation in the per cent of quail over

150 days old and in the per cent of adults which had matured or nearly matured primary flight feathers (Table 2). The percentage of adults remained at 13 or 14 per cent.

Table 2

Per Cent of Quail Over 150 Days Old and Per Cent of Adults With Matured Primaries—1952, 1956, 1957, 1959

Year	Per Cent of Young Over 150 Days Old	Per Cent of Adults with Matured or Nearly Matured Primaries
1952	54	60
1956	48	60
1957	54	40
1959	32	31

Within a population of upland birds the losses begin as soon as the young appear. Burger (1959) reported that in an un hunted Wisconsin population of pheasants, four out of five young did not survive until winter. Marsden and Baskett (1958) reported that in Missouri 82 per cent of a banded population of wild quail died each year. It may be expected that varying conditions will influence survival regardless of what the production may have been.

Referring again to Figure 1, it may be observed that quail brooding seasons since 1952 have varied widely in the amount of time during which production was high. There has been also considerable variation since 1952 in the percentage of adults in the bag.

In the best production years when there was also fine hunting, the bag was composed of a smaller percentage of young than in low production years. More of the adults had matured primaries. Since it was indicated that there were more quail in 1954 and 1958 than in 1953 or 1955, it would be presumed that there would be a similar percentage of adults during each of the similar years.

However, in 1954, there was an early hatch, early maturity of some of the young, and low take of adults. In 1958, the hatch was later, young matured later, and the take of adults was comparatively high.

Regarding some influences on the take of young and adults, Baker (1953), Stoddard (1931), and Stempel (1957) found that either directly or indirectly the weather pattern influenced wing moult. Shelford and Yeatter (1955) pointed out that there were sensitive periods for prairie chickens; one of these was connected with moult.

That condition of primaries may affect flight and thus make some birds more vulnerable to the gun is illustrated by Daniell (1955), who indicated that only chukar partridges in prime condition made a high percentage of good flights. Dickey (1959) discussed size and

condition as it affected the flight of quail. All studies indicated that birds in prime condition made the best flights. This would indicate that birds not having prime flight feathers were easily taken by hunters.

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