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SECOND BROODS IN BOBWHITE QUAIL

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Abstract:

Data on second broods in bobwhite quail is limited due to a lack of information on molting patterns, quiescence of female gonads, nesting chronology, and parental behavior in males and females.

An analysis of these factors is presented along with a discussion of 19 occurrences of second-clutches in Missouri. The impact of second broods on quail populations is discussed.

Of many topics pertaining to the life history and biology of bobwhite quail, that relating to second broods is most shrouded in speculation and mystery. The lack of information is due to 2 factors: (A) time involved in studying an entire nesting season to secure second-brood data, and (B) difficulty of observing the double-brood sequence in wild populations. Chance observation is an important factor.

But awareness that second broods exist is the greatest key to understanding the subject. By learning the patterns of quail behavior and production associated with second broods, we increase our chance of evaluating the phenomenon.

The occurrence of second broods in bobwhites seems to have been fairly common knowledge to earlier ornithologists and to rural folks having opportunity to observe pairs producing first and second broods. However, the occurrence of second broods has been questioned or denied by many students of bobwhite behavior, despite strong indications that they may be common in normal reproduction, and perhaps a most important factor in the rapid recovery of quail populations following severe population "lows."

I do not question the occurrence of second broods for bobwhites; second broods are a documented reality. The question is, how many occur, and under what specific conditions are they most likely to occur?

Dr. Frank H. Knowlton of the U. S. National Museum stated (5) of the bobwhite quail, "The male assists in caring for the young, taking full charge of the first brood while the female is hatching the second." Bent (1) also referred to second broods in bobwhite, but expressed doubt as to the existence of proof of such occurrences.

Since these writings, some people have accepted as fact that bobwhite quail have second broods; others have not. Many biologists have been skeptical that second broods are a logically expected occurrence in the life cycle of such a short-lived, high-turnover species as the bobwhite quail. Some commentators have misquoted facts or expressed undocumented beliefs in concluding that bobwhite lack second broods. It is time to set the records straight on this most interesting subject.

Workers who have devoted considerable time to the study of bobwhite population dynamics and reproductive behavior have often knowingly or unknowingly made observations that indicate a possibility of second broods. Hickey (4) stated "Because the number of young per adult is roughly twice that of any other galliform species thus far reported, speculation always seems to arise that this species may raise 2 broods. This possibility ought to be settled by close observation of marked birds under semi-captive conditions." Lehman (6), in observing and studying population fluctuations of Texas bobwhite quail, considered ". . . the possibility of not only 1 brood of young from most pairs, but 2 broods in a single season from some."

Frank Schley (8) discussed first and second broods in quail so logically that one can easily relate to the rural observation and discussions that form the basis of the article. Present day stories about observations of second broods by rural people ("first brood under the spirea bush and then the renesting hen under the climbing rose with the hen joining the cock and young in the road for feeding") parallel Schley's conclusions.

Unfortunately, we have too often discarded such observations by rural individuals who have often lived closer to the birds than do many people who write about them. Stoddard (11), while not recording occurrences of second broods in his most excellent work, would have, I believe, ultimately observed them had his carefully concentrated nesting-production studies continued. The accumulated evidence of most long-term work gradually points to the occurrence of second broods. Stoddard states, ". . . many broods are encountered afield in charge of one parent." But his subject reference pertains to topics other than second broods. I believe that time alone would have expanded his findings to include second broods, if they are characteristic of quail in the southeastern portion of the range. This latter comment is made because of the possibility that an inclination for second broods may be more characteristic of birds in the more rigorous portions (snow-cold and droughty fringe areas) of the quail's range. Francis (2) speculated that second broods were a possibility in California quail (Lophortyx californicus). Gullion (3) also found evidence of second broods in Gambel's quail (Lophortyx gambelii). Thus, there accumulates interesting speculation and evidence that point to the possibilities of more than 1 brood per season in bobwhites and related Galliformes.

Today there arise repeatedly, under topics of facts, fancies and myths in game biology, so-called logical reasons why bobwhite quail cannot or do not have second broods. To clear the record on these traditional misbeliefs, I offer the following comments based on investigations of bobwhite quail production in Missouri.

1. A most authoritative reason given for no second broods in bobwhite quail is that "Stoddard says so." I have heard this reason given by professional scholars and biologists who should have known better.

ANSWER: This is a gross misstatement of Mr. Stoddard's reference to second broods. In his book *The Bobwhite Quail* (11) he states. ". . . no evidence of attempts to produce

second broods, when a first was successful, came to light during the course of the investigation." In discussing this topic with Mr. Stoddard, however, I received strong encouragement from him to pursue further studies "that might reveal the occurrence and place of second broods in bobwhite biology."

2. "Bobwhite quail can't raise second broods because the hen must brood the young." This statement ties in closely with the quote that "second broods are an impossibility because 'everybody knows' that it takes about 170 days or around 5.5 months to produce and rear a brood of quail; there just isn't time to have 2 broods."

ANSWER: Bobwhite chicks are definitely brooded early in life by both male and female parents. The male bird readily assumes brooding duties when a hen is lost or renests for a second brood. My data show that a hen will renest within 8 days after hatching brood number 1, and that the cock readily takes over brooding and rearing duties. The hen appears to lose all interest in the first brood at such times. Thus, by sharing care of the brood, quail pairs can, and do, have the physical and behavioral capabilities to rear 2 broods in 1 production year.

Figure 2 shows that the total time involved in producing double broods from first nesting to completion of molt by hen and young may vary from 247 days (7 June hatch) to 194 days (19 July hatch).

3. Hens are no longer in adequate physical condition to produce and rear a second brood after incubating a clutch and hatching it.

ANSWER: This has been partially answered in the preceding question. Many hens successfully hatching first clutches during June possess quiescent gonads through early August, which may be activated to laying condition shortly after the chicks are hatched or even after 10-day-old young are lost.

4. After successfully completing and hatching a clutch, quail hens molt; such molting is recognized as the cessation of active productive effort.

ANSWER: The latter portion of this statement is partially correct because molting usually, but not always, signifies the end of production effort. Actually, after an early onset of molt and the replacement of 1 or 2 primaries, a hen may be triggered to cease molting, resume nesting, and produce a second clutch or brood. The statement that hen quail molt immediately after hatching their young (as is typical of some chickens) is false. Data from Missouri for "normal" production years show that about 18% of the hens hatching chicks in June undergo onset of molt within 2 weeks following the hatch; the remainder molt later in the summer. Many hens with broods may not molt until late in August or even early September (Stanford 1972). Thus, many hens not molting in June, July, or August remain in condition to have clutches of eggs through mid-August and occasionally into early September. A few hens nest as late as September.

Fig. 1 presents production phenology of Missouri quail and hen molting patterns for "normal" weather years.

5. When quail pairs are observed in late July through September with young of 2 age groups, 1 "age-size" represents "strays" that have been adopted. They are not from second broods.
ANSWER: Although the above may actually happen, there is ample evidence that family groups constituted of young of 2 age classes may be the product of successful first and second broods. Careful observations bear this out as do collections of hen and young, which often reveal that the youngest chicks are the product of a hen with full brood patch, and that all young are of proper age to be from a first and second brood sequence.

Also, limited studies of adoption tendencies in wild quail, strongly indicate that wild hens are not as prone to adopt small, strange birds as is popularly supposed. Much remains to be learned concerning wild hen response to, and acceptance of, chicks other than their own.

One could go on discussing such misconceptions that are offered to debunk the second-brood concept. The facts easily override such contentions. Actually quail can, and do, have second broods and probably to an extent far greater than we realize.

Quail production and molt studies in Missouri have been in progress for 25 years. Original study objectives did not provide for observations on second broods; however, the accumulated evidence through years of study and observation have removed all doubt as to the physiological ability and behavioral potential of quail pairs to produce and rear 2 broods per season.

Since 1950, our quail projects have involved an annual average of 30 January-February wild-trapped pairs held in isolated field-ground pens. Observation and study of monthly production and primary feather molt patterns of young birds and adult hens (some cocks) have been the major objectives. But through the years, wild pairs having second broods occurred to such a degree that studying them became a separate "spin off" project.

Stanford (9), after 6 years of bobwhite field studies, reported field observations of second broods in a feral pair and 2 wild pairs held in isolated ground pens, all in the same year. Such observations were not designed to be a study of second broods, but the work turned out that way.

During the last 2 decades, we have accumulated considerable data on molt onset and progression of primary molt in young and adult wild birds, along with much information on nesting behavior of bobwhite quail (Stanford, unpublished). The data have been supplemented with annual field collections of wild birds in various stages of producing and rearing broods. These studies, and information from other quail investigations in Missouri, show that:

1. Bobwhite quail in Missouri abandon winter covey units around mid-to-late April. Mass nesting efforts during May produce a first hatching peak at about 15 June which yields 64% of the annual crop of young. July-August nesting effort of (A) late nesting birds, (B) birds that have lost early clutches or broods, and (C) possibly successful first-brood hens attempting second broods result in a second hatching peak at around 15 August. This later effort contributes about 36% of the annual production. The period of egg-laying through hatching embraces about 122 days (May through August).
2. Hens associated with the 15 June hatching peak may or may not begin molt. Approximately 18% do molt at this time, but the remainder do not, remaining in a potentially productive condition until a much later onset of molt. A study of wild birds in the field and wild pairs in pens plus the annual analysis of the molt pattern of 10,000 hen wings collected from hunters show that most hens begin molting during late July, August, and early September (Fig. 1).
3. During the early and middle portions of the annual production season, many hens remain in a physiological condition to mate, lay eggs, and produce young. Some male birds are receptive to mating and are capable of fertilizing these hens.
4. Along with the many field observations of wild, mixed-age, July-August young, some of which may be second broods, we have recorded and followed through on 19 documented cases of second brood attempts in wild bobwhite (feral and penned wild birds). Of these 19 fertile, second clutches following first broods, 14 hens successfully hatched young while the male cared for the first brood. The 5 unsuccessful second clutches failed because the hens were lost to blackhead or to predation, or they deserted their nests.
5. Onset dates of molt of some second-clutch and/or second-brood hens reveal the delay of onset of molt in bobwhite quail during a nesting season: 12, 15, 24, 28 July; 3, 5, 5, 9, 15, 19, 20, 27 August; 4, 5, 5, 12 September.
6. Of the birds involved in second brood attempts, 11 (58%) were adult hens and 8 (42%) were yearling birds. On the basis of age groups in the nesting studies, adult hens appear to be 5.5 times more likely to attempt second broods than do yearling hens. Most renesting attempts occur from late June through early August.

Should the high percentage of adult hens showing propensity for second broods be applicable to the wild, we might assume that second broods would never reach significant proportions. Under normal conditions, adult hens represent only a rather small percentage of a nesting population.

Following severe winter snow-cold conditions and during and following prolonged high-temperature drought, normal age structures may be so altered as to cause significant changes from the normal pattern of reproduction. High population densities concentrated in limited habitat, accelerated production efforts resulting from markedly improved habitat in previously drought-seared areas, and a greater-than-normal proportion of adult hens following a severe drought period with poor production may interact to set the stage for much production of second broods. Rapid population changes from extreme lows to sudden, dramatic highs (irruptions) may well result from the quail hen's ability to fill an expanding habitat by second-brooding.

Our data clearly document the occurrence of second broods and shed much light on the chronology of such events as nesting, onset of molt, and completion time of primary molt in both hens and young. Fig. 2 presents comparative data for 1 single-brood occurrence and 2 second-brood attempts that were documented for hen and young over the entire production-growing period.

Of particular interest is the timing of primary molt onset in hens at different nesting periods, and the time required for completion of primary feather growth. For both adult hens and their young, the time required for feather growth shortens when the production-molting events occur late in the nesting period. The marked variation in primary feather growth of young wild quail is striking when compared with similar growth information based upon pen-reared birds (7).

I conclude that while second broods are most difficult to study and carefully document, their occurrence in a quail population probably adds far more young to an annual bird crop than we are aware of or may ever be able to ascertain. Studies on the droughty, fringe areas of the quail's range may have the greatest potentiality for providing large amounts of information on second broods.

Additional studies, based on an awareness of the bobwhite's potentiality for producing second broods should be forthcoming through careful observations. Collecting adult and young birds and paying special attention to the study of molt, brood patch and primary feather growth progression also may provide new insights on this subject.

The case for documented information on second broods in bobwhite quail does not rest, but goes on in Missouri quail studies. Although we know that quail can and do have second broods far more than we previously suspected, the all-important questions remain as to how much, and under what environmental-population conditions.

Such questions provide a challenge in continuing studies of the bobwhite quail--and in time, they will undoubtedly be answered.

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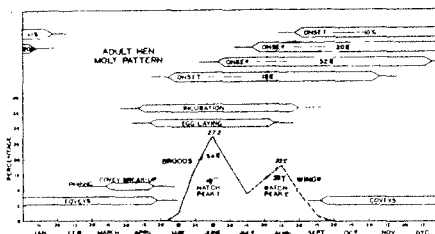


Figure 1. Annual reproduction-behavior-molt phenology of Missouri bobwhite quail.

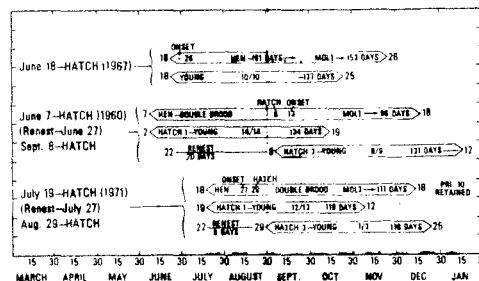


Figure 2. Hatching and primary feather growth in adult hens and young in single and double broods of bobwhite quail in Missouri; birds trapped in February and held in field ground pens.