

RENESTING BEHAVIOR IN THE RING-NECKED PHEASANT

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PERSISTENCY in renesting has long been recognized in Ring-necked Pheasants (*Phasianus colchicus*). Nesting studies almost invariably reveal that the number of nests on a given area is greater than the number of hens known to be nesting there or that the percentage of hens that eventually produces a brood is higher than the percentage of nests successful (Linder et al., 1960; Stokes, 1954; Trautman, 1960; and others). In addition, Seubert (1952) found much evidence of renesting in pheasants under pen conditions. Aside from a single record reported by Warnock and Joselyn (1964), however, no information on renesting behavior is available based on the observation of marked individuals in the wild. This paper describes renesting for backtagged pheasants on a study area in east central Wisconsin.

AREA AND METHODS

This study was conducted in 1959–64 on a 10-mile-square area in southwestern Fond du Lac County and adjacent parts of Dodge and Green Lake counties, Wisconsin.

As part of a long-term study of movements and survival by the Wisconsin Conservation Department, pheasants were captured by bait trapping in winter (January–March) and by nightlighting (Labisky, 1959) in early autumn (September–October). Each hen captured was marked with an individually numbered plastic backtag (Blank and Ash, 1956) and with an aluminum band on each leg. A total of 2,253 hens was marked and released through March 1964. Age determinations were based on bursal depths, with 5 mm used as the separation point between adult and juvenile hens.

Concurrent studies afforded opportunities to find nests and broods of marked hens. Renesting records described in this paper were for birds whose nests were destroyed mainly by natural causes. In order to backdate nest histories to the date of nest establishment, one egg from each active clutch was sacrificed to determine the stage of incubation at nest discovery (Labisky and Opsahl, 1958). A laying rate of 1.3 days per egg (Buss et al., 1951) and an incubation period of 23 days were used in backdating. In instances where information on clutch size was unavailable, backdating was based on an assumed clutch size of 10 eggs.

CASE HISTORIES

Blue HO.—This hen was originally captured as a juvenile on 7 March 1960. On 1 June 1961, she was flushed from a nest concealed in reed–canary grass (*Phalaris arundinacea*)

along a drainage ditch 0.36 mile from the trap site. The clutch consisted of seven unincubated eggs. When the nest was checked on 5 July, it still contained six eggs (one egg had been previously removed for age determination). Apparently the hen abandoned the clutch as the result of its discovery.

On 19 June, *Blue HO* was killed by a hay mower on a nest in an alfalfa (*Medicago sativa*) field 0.21 mile from the previous nest. The second clutch consisted of 10 eggs in the fourth day of incubation. Since the starting date of the second clutch was estimated to be 2 June, renesting must have begun the day after the previous clutch was deserted.

White C3.—This hen was trapped as an adult on 30 January 1960. On 1 June 1960, she was flushed from a nest 0.63 mile from the trap site. The nest was concealed in fencerow cover consisting chiefly of quack grass (*Agropyron repens*). It contained 16 eggs in the second day of incubation. The nest was checked on 25 June, when all eggs were found to be missing. No information was available concerning the cause or date of its failure.

On 26 July, this hen was found renesting in another fenceline 0.54 mile from her first nest. The hen was not flushed from the clutch, and when it was checked on 11 August, it had already hatched. The clutch consisted of seven eggs, two of which contained dead embryos. No estimate of its starting date was available.

Yellow N4.—On 26 February 1960, this hen was captured as a juvenile. On 5 June 1961, she was flushed from an unincubated eight-egg clutch concealed in reed-canary grass and goldenrod (*Solidago* sp.) 0.75 mile from the trap site. The clutch still consisted of eight eggs when checked on 1 July, apparently having been deserted at the time of its discovery.

On 21 June, *Yellow N4* was killed on a mowed-over nest in a red clover (*Trifolium pratense*) hayfield 0.14 mile from the previous nest. The clutch consisted of 11 eggs in the third day of incubation. Its calculated starting date was therefore 4 June, indicating that renesting must have begun immediately after the desertion of the first clutch.

Coral X4.—This hen was captured as an adult on 11 March 1960. On 31 May 1960, she was found nesting along a fencerow in quack grass cover 0.50 mile from the trap site. She did not flush from the nest, and no information on clutch size or stage of incubation was obtained. When the nest was checked on 11 June, shell fragments from a minimum of eight eggs were found. The clutch appeared to have been destroyed by a skunk (*Mephitis mephitis*).

On 3 October 1960, *Coral X4* was observed with an 11-week-old brood 0.25 mile south of the nest site. On the assumption that the clutch which produced this brood numbered 10 eggs, renesting must have begun about 12 June.

During the 1961-63 nesting seasons, *Coral X4* was seen several times in the same vicinity; and on 11 May 1963, she was found nesting in roadside cover 0.38 mile northeast of her 1960 nest. Cover at the site consisted chiefly of cordgrass (*Spartina pectinata*). The nest was checked on 14 May, with the hen absent, at which time it contained 13 unincubated eggs. When next visited, on 17 May, it contained 15 eggs which had been destroyed by an unidentified predator, probably on 16 May.

On 19 June, this hen was killed by a hay mower in a red clover hayfield 0.16 mile from the previous nest. The clutch consisted of 10 eggs in the 20th day of incubation. Renesting apparently began on 17 May, the day after the previous clutch was destroyed.

Red 40.—This bird was captured as a juvenile on 3 October 1960. On 5 June 1961, she was flushed from a nest in sedge (*Carex stricta*)—goldenrod cover 0.71 mile from the trap site. The clutch consisted of 11 eggs in the 13th day of incubation. When checked

on 11 June, it was found to have been preyed upon, apparently by a skunk. One intact egg with a 17-day embryo placed the date of nest destruction at about 9 June.

On 30 June, leg bands from *Red 40* were found next to a mowed-over nest in a red clover hayfield. This nest was 0.32 mile from the first. It contained eight unincubated eggs, indicating that renesting had started on 20 June, 11 days after the destruction of the first clutch.

Red 11.—On 13 September 1960, this hen was captured as an adult. On 23 May 1961, she was found incubating a clutch concealed in reed-canary grass along a roadside 0.38 mile from the capture site. She was not flushed from the nest. When the nest was checked on 12 June, it was found to contain 14 eggs that had been recently destroyed by an unidentified mammal. Presence of chick feathers adhering to the insides of several eggshells indicated that the clutch was in an advanced stage of incubation when destroyed.

Sometime between 15 and 18 June, this hen was hit and killed by a hay chopper in an alfalfa field 0.24 mile from her previous nest. The eggs were so badly crushed by farm machinery that no information on clutch size or stage of incubation could be obtained.

Light Blue S5.—This hen was caught as a juvenile on 15 March 1962. On 23 May 1962, a hen with an unidentified light blue tag was flushed from an unincubated eight-egg clutch 0.12 mile from the trap site. The nest was located in roadside cover, concealed in quack grass and goldenrod. On 26 May, the identity of this hen was established when she was observed at the nest. When the nest was next checked on 12 June, remains of only two destroyed eggs were found. Neither the cause nor the exact date of nest destruction could be established. Evidence of blood vessels inside the broken eggshells indicated that the clutch had reached at least the early stages of incubation before it was destroyed.

On 20 June, this hen was killed by a hay mower 0.11 mile from the original nest site. The nest was not found until 24 June, and after this lengthy delay it was impossible to determine the size of the clutch and the stage of incubation when destroyed.

Green V8.—This bird was trapped as an adult on 30 January 1962. On 6 June 1962, she was found nesting in sedge-goldenrod cover 0.41 mile from the trap site. The next day the clutch was destroyed when the cover in which it was located was disced and plowed. The clutch comprised 22 eggs, all of which were fertile and in the 13th day of incubation.

On 25 June, this hen was killed by a hay mower in an alfalfa field 0.19 mile from the original nest site. The second clutch consisted of five unincubated eggs, indicating that renesting began about 18 June, 12 days after the destruction of the first clutch.

Green J3.—This bird was trapped as a juvenile on 1 February 1962. On 3 June 1962, she was found on a nest concealed in sedge and bluejoint grass (*Calamagrostis canadensis*) 0.47 mile from the trap site. On 6 June, the nest was destroyed by a marsh fire.

On 17 September, *Green J3* was recaptured by nightlighting 0.23 mile from the nest site. She was accompanied by six chicks, assumed to be her brood, whose wing molts indicated that they were approximately nine weeks old. If it is assumed that this bird's renest clutch consisted of 10 eggs, then she must have started renesting about 10 June.

White 87.—This hen was captured as an adult on 24 September 1962. On 1 June 1963, she was observed incubating a clutch in roadside cover 0.35 mile from the capture site. Nest concealment was furnished by quack grass, sunflower (*Helianthus annuus*), and burdock (*Arctium minus*). On 10 June, the nest was destroyed when it was driven over by farm machinery, at which time it contained 12 eggs in the 20th day of incubation.

On 26 June, this hen was flushed from a nest in an uncut alfalfa hayfield. The clutch consisted of four unincubated eggs and was located 0.09 mile from the previous nesting

attempt. Renesting apparently began on 21 June, or 11 days after the destruction of the first clutch.

Yellow 7X.—This hen was caught as a juvenile on 1 March 1963. On 25 May, she was flushed from a nest 0.08 mile from the trap site. The nest was concealed in roadside cover consisting of meadow rue (*Thalictrum dasycarpum*) and wild parsnip (*Pastinaca sativa*). Clutch size was 10 and the eggs were in the sixth day of incubation. When the nest was checked on 9 June, it was found to have been destroyed, probably by a skunk. The date of nest destruction was estimated at 5 June.

On 7 August, this hen was killed by a hay mower in a red clover hayfield 0.42 mile from her previous nest. The eggs were incubated, but the exact clutch size and stage of incubation could not be determined. At the very earliest, this renesting attempt could not have been established before 1 July, whereas the previous nest of this bird was destroyed about 5 June. Thus this hen may have renested unsuccessfully at least one other time.

Yellow 64.—This hen was captured as a juvenile on 1 February 1963. On 12 May 1964, a clutch of five eggs was found in a roadside stand of quack grass and Canada thistle (*Cirsium arvense*) 3.8 miles from the trap site; and on 16 May, *Yellow 64* was observed on this clutch. A later check on 25 May revealed nine unincubated eggs which appeared to have been abandoned, and a final check on 27 May confirmed this fate.

On 1 June, this hen was flushed from a nest located along a ditchbank 0.15 mile from the first nest. The nest was concealed in bluegrass (*Poa pratensis*) and contained 11 unincubated eggs. The hen did not return. Backdating of this clutch indicated that renesting began on 18 May.

On 25 August, *Yellow 64* was observed in the same vicinity with a brood of seven 4-week-old chicks. On the assumption that the clutch which produced this brood comprised 10 eggs, *Yellow 64* must have started another renesting attempt no earlier than 22 June. The 22-day difference between this date and the date that her second nest was deserted indicates that she also may have renested at least one other time. Thus this individual may have made four nesting attempts in 1964.

CONCLUSIONS AND DISCUSSION

The percentage of hens that renest after the desertion or destruction of a clutch is an elusive statistic. In this study, 32 marked hens were found on nests later deserted or destroyed by nest predators. Of these, nest and brood records show that a minimum of 13 renested at least once. One individual (*Yellow 64*) was known to renest twice and may have renested three times. Another hen (*Yellow 7X*) also apparently renested twice. Nest searching in this study involved a sampling procedure in which only about 30 per cent of the available nesting cover was examined, and no attempts were specifically made to search for the renests of marked hens. These data imply a rather high level of renesting activity. Direct evidence obtained by marked individuals thus substantiates the importance of renesting in pheasants as indirectly revealed by numerous nesting studies (e.g., Linder et al., 1960; Stokes, 1954; and Trautman, 1960).

Nesting studies on this area from 1959–64 have revealed an average hatch-

ing success of 29 per cent and 1.8 nests per breeding hen (unpublished data). In a hypothetical model based on 100 hens at the start of nesting, for every 71 hens that failed in their first nesting attempts, an average of 80 reneesting attempts followed. Under actual conditions, however, some nesting hens were being removed by natural mortality throughout the nesting season. Thus it appeared that nearly all surviving hens whose first nests were broken up must have reneested, and that a substantial fraction of those whose reneesting efforts were unsuccessful must have reneested a second time.

Available evidence, though limited, suggests that adult hens were more persistent reneesters than juveniles. The 32 unsuccessful tagged hens in this study included 15 adults and 17 juveniles. Among adults, 10 reneesting records for nine individuals were obtained. Among juveniles, only four reneesting attempts for four individuals were known. Reproductive superiority in adults is also suggested by results of certain pen studies (Kabat and Thompson, 1963:120-122). In these experiments, adults started egg laying earlier, did less random egg laying, and eventually laid a larger number of clutches than juvenile hens.

Of the 14 reneesting records described in this paper, six followed the loss of unincubated clutches, seven followed the loss of incubated clutches, and one followed the loss of a clutch of unknown status. Four of the six hens whose clutches were disrupted before the end of egg laying immediately resumed nesting elsewhere. Continuous laying of this sort has also been reported for ducks where nests are destroyed before egg laying has terminated (Sowls, 1955:134-136).

A different situation exists when clutches are destroyed during incubation. After the start of incubation, the ovaries begin to regress; accordingly, a period of renewed ovarian development, the reneesting interval, must take place before egg laying can be resumed. In ducks and pheasants, Sowls (1955:132-133) and Seubert (1952), respectively, have shown that the reneesting interval lengthens as the stage of incubation advances. Reneesting intervals could be estimated in only three instances in the present study. One hen required 11 days to renew egg laying after the loss of a clutch in the 17th day of incubation, another required 12 days after the 13th day, and a third required 11 days after the 20th day. Each of these fit into the pattern of reneesting intervals observed by Seubert (1952) in penned birds.

Most reneesting hens appeared to remain in the vicinity of their original nest sites. The average distance between successive nesting attempts was only 0.23 mile.

A striking difference in cover used for reneesting was also evident. For 13 hens that provided reneesting records, apparent first nests were distributed as follows: six in roadsides, four in wetlands, two in fencelines, and one in

ditchbank cover. But of the 11 renesting attempts located, nine were in hayfields and only two were in other cover types. Early nesting attempts thus were located primarily in permanent cover, whereas renesting occurred mainly in hayfields. A similar trend in cover selection was reported by Buss (1946: 43-45). In the present study, hayfields did not grow to sufficient height to furnish nest concealment (8-10 inches) until mid-May, whereas nesting was usually well under way by early May. Thus hayfields were largely unavailable for early nesting.

The attractiveness of hay for renesting results in a serious drain on reproductive success, since renesting hens usually have too little time to finish incubation before hay mowing takes place. In the present study, hatching success in hay averaged only 15 ± 1.4 per cent ($N = 641$), compared to 35 ± 2.0 per cent ($N = 556$) in permanent cover types. Low rates of hatching in mowed hayfields are, of course, well known from numerous other nesting studies.

SUMMARY

Fourteen records of renesting for backtagged pheasants were obtained in 1959-64 on a study area in east central Wisconsin. These and other nesting data suggest that all unsuccessful hens renested at least once, and that a sizeable fraction must have renested more than once. Adult hens appeared to be more persistent renesters than juvenile hens. Renesting hens remained in the vicinity of their original nest sites. Initial nesting attempts were situated principally in permanent cover types, whereas renesting occurred mainly in hayfields.

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