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NESTING BEHAVIOR OF FEMALE WHITE-TAILED PTARMIGAN IN COLORADO

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Few detailed observations on behavior of nesting grouse have been reported. Notable exceptions are those of Schladweiler (1968) and Maxson (1977) who studied feeding behavior and activity patterns of Ruffed Grouse (*Bonasa umbellus*) in Minnesota, and McCourt et al. (1973) who documented nest attentiveness of Spruce Grouse (*Canachites canadensis*) in southwestern Alberta. White-tailed Ptarmigan (*Lagopus leucurus*) have been intensively studied in Colorado since 1965 (Braun and Rogers 1971, Braun and Schmidt 1971, May and Braun 1972, Hoffman and Braun 1975, 1977). We describe and discuss here various behavioral adaptations used by female White-tailed Ptarmigan during nesting.

STUDY AREA AND METHODS

Data were collected during 1975 and 1976 at the Trail Ridge study area in Rocky Mountain National Park, Colorado (Giesen 1977). We located territorial pairs in spring employing tape-recorded calls (Braun et al. 1973). We found nests by following hens during laying or after feeding periods during incubation; a few nests were found incidentally. Nests were checked at irregular intervals until either they were lost to predation or the eggs hatched. Data collected at each visit included date, time, weather, and activity and behavior of the hens. In 1976, the activities of the females at three nests were monitored with time-lapse photography (1 frame/min). Super-8 movie cameras were positioned in late afternoon and retrieved the following morning. Field techniques for capturing and marking birds were described by Braun and Rogers (1971).

Twenty-one active White-tailed Ptarmigan nests were found in 1975 and 1976. We observed these nests 24 times during egg laying (range 0-5 observations per nest) and 163 times during incubation (range 0-20 observations per nest). The number of observations per nest was related to the duration of occupancy by the hens. Three nests were destroyed before incubation and eight more were lost to predation before hatching. Rarely (<3% of all observations) was a nest checked more than once a day and none was visited more than twice daily.

RESULTS

Observations of ten hens during the egg laying period revealed that they actively foraged within the males' territories 100 to 300 m from their nests prior to egg deposition. During this time they were accompanied by the males. As time for egg deposition approached, the hens walked or ran directly to the site, usually arriving in less than 10 min. All hens arrived at the nest site between 09:00 and 14:30. They removed vegetation covering the eggs with their bills, before

settling on the clutches. By lifting the hens off their nests, we learned that eggs were laid almost immediately after settling.

After eggs were laid, the hens remained relatively inactive until they prepared to depart from the nest. Observations of six hens in 1975 indicated that they remained on the nest for longer periods as the clutch approached completion. One hen depositing her second egg remained on her nest for 44 min, whereas another, depositing the fifth egg of a six-egg clutch, remained on the nest more than 280 min. Three hens remained on their nests 84 to 153 min when laying their second or third eggs. Spruce Grouse also show this pattern of nest attentiveness (Mccourt et al. 1973).

Before departing from the nest, the hen began to peck at vegetation and place it at the rim of the nest, or throw it over her back. This behavior lasted 34, 40 and 64 min for three hens. Vegetation was deposited on the nest at the rate of 20 pieces per minute. After the rim of the nest was built up, females stood near the nest and began dropping vegetation onto the eggs. All vegetation placed on the nest was gathered within 40 cm of the nest. Females left their nests after the eggs were completely covered.

One instance of displaced egg-covering activity was observed when a hen was accidentally flushed from her nest after she had deposited her third egg. She flew about eight meters from the nest and spent 20 min placing vegetation around her as if she had been on her nest. The behavior appeared identical to actual egg covering observed in other hens. Bump et al. (1947) reported similar behavior in female Ruffed Grouse away from nests but refuted the claim that eggs were deliberately covered by hens.

We determined nest attentiveness by checking 19 incubated nests in 1975 and 1976. Of 163 observations during the day (07:30-19:00), hens were seen incubating on 155 occasions (95.1%).

We attempted to document crepuscular feeding patterns of nesting hens in 1976 using time-lapse photography of nests. Most feeding presumably occurred after sundown or before sunrise, because only one daytime nest absence was recorded in 18 camera days. Nocturnal activities could not be documented using this technique. Each year 10-20 individually marked hens known or assumed to be incubating were observed feeding 15-60 min after sundown. These birds fed 15-20 min at areas of snow accumulation within 300 m of their nests and returned to the same areas on consecutive evenings. The male usually joined the hen at the feeding site and assumed threatening postures and uttered vocal challenges when approached by an observer. The hen usually ignored the male and actively fed on willow (*Salix* spp.), buttercup (*Ranunculus adoneus*) and mountain dryad (*Dryas octapetala*; Schmidt 1969). Hens usually flew to and from feeding areas, although some were seen to walk part way to their nests. Incubating females deposited "clocker" droppings (a fecal pellet characteristic of incubating hens) soon after arriving at feeding areas.

During the day, hens allowed close approach by humans. As incubation progressed we were often able to touch the hen on the nest before she flushed. Hens which flushed from the nest usually performed distraction displays within three meters of the observer. These displays included a hissing or clucking call, while the hen exposed the white carpal patches and repeatedly advanced and retreated (Schmidt 1969).

Hens returned to the nest within two minutes after the observer left the immediate area.

If a white feather had been displaced from the nest hens would pick it up and swallow it. Most nests contained several white feathers molted by the hen during incubation, but only feathers displaced out of the nest were observed to be eaten.

Some hens retrieved eggs displaced within 18 cm of the nest; for a full account of this behavior see Giesen (1978).

DISCUSSION

Many of the behavior patterns of nesting White-tailed Ptarmigan described here probably help to reduce avian and mammalian nest predation. Females of this species delay nesting activities until completely in the cryptic nuptial plumage. Nests are deliberately covered with vegetation after egg deposition. The nest covering may also function as insulation from freezing temperatures. This behavior has also been observed for Rock Ptarmigan (*Lagopus mutus*; MacDonald 1970). During incubation, the clutch is exposed when the hen leaves the nest to feed. Since feeding periods are brief (15–20 min) and occur before sunrise or after sunset there is little opportunity for avian nest predators, primarily Common Ravens (*Corvus corax*), to find clutches. Observations of 62 nests since 1966 indicate that only one was lost to corvid predation (Giesen et al. unpubl. data). On four of eight occasions when incubating hens left their nests to feed during the day visibility was poor due to snow, rain or fog. Watson (1972) reported that Rock Ptarmigan leave the nest four to six times daily for feeding. This may be due to the longer day length at higher latitudes, although the total time spent feeding (1.5 h/day) was twice what we noted for White-tailed Ptarmigan (30–45 min/day).

Distraction behavior of hens flushed from nests may serve to protect eggs from mammalian predators. We did not witness this display in response to mammals other than humans, so its effectiveness is unknown. Predation rate on 60 nests located since 1966 was 43% (Giesen et al., unpubl. data). This is lower than the 55.5% loss reported by Nice (1957) for 5,597 galliform nests. In Red Grouse (*L. lagopus scoticus*), both sexes are said to perform distraction displays when the nest site is disturbed (Watson and Jenkins 1964), but in White-tailed Ptarmigan we have seen only females perform such behavior.

Eating feathers and retrieving eggs render nests less conspicuous. White feathers and eggs are highly visible on alpine tundra and may attract nest predators, whereas the cryptically colored hen may be overlooked.

SUMMARY

Behavior and activity patterns of 21 female White-tailed Ptarmigan were observed during the nesting seasons of 1975 and 1976. Laying hens increased time on the nest as clutches neared completion. After deposition, eggs were covered with vegetation by the hen until they were no longer visible. During incubation, nest attentiveness exceeded 95% from sunrise to sunset. Feeding periods of incubating hens lasted 15–20 min and occurred primarily at dawn or dusk. Feeding sites were 50–300 m from nests and were used consistently by individual hens. Incubating hens allowed close approach by human observers but performed distraction behaviors when flushed from the nest. Eating white feathers and retrieving eggs are

behaviors that appear to reduce the likelihood of nest predation.

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LITERATURE CITED

- BRAUN, C. E., AND G. E. ROGERS. 1971. The White-tailed Ptarmigan in Colorado. Colorado Div. Game, Fish and Parks Tech. Publ. 27.
- BRAUN, C. E., AND R. K. SCHMIDT, JR. 1971. Effects of snow and wind on wintering populations of White-tailed Ptarmigan in Colorado, p. 238–250. In A. O. Haugen [ed.], Proc. Snow and Ice Symposium. Iowa Coop. Wildl. Res. Unit, Iowa State Univ., Ames.
- BRAUN, C. E., R. K. SCHMIDT, JR., AND G. E. ROGERS. 1973. Census of Colorado White-tailed Ptarmigan with tape recorded calls. J. Wildl. Manage. 37:90–93.
- BUMP, G., R. W. DARROW, F. C. EDMINSTER, AND W. P. CRISSEY. 1947. The Ruffed Grouse: life history, propagation, management. New York Conserv. Dept., Hilling Press, Inc., Buffalo.
- GIESEN, K. 1977. Mortality and dispersal of juvenile White-tailed Ptarmigan. M.S. Thesis. Colorado State Univ., Fort Collins.
- GIESEN, K. 1978. Egg retrieval by incubating White-tailed Ptarmigan. Auk 95:761–762.
- HOFFMAN, R. W., AND C. E. BRAUN. 1975. Migration of a wintering population of White-tailed Ptarmigan in Colorado. J. Wildl. Manage. 39:485–490.
- HOFFMAN, R. W., AND C. E. BRAUN. 1977. Characteristics of a wintering population of White-tailed Ptarmigan in Colorado. Wilson Bull. 89:107–115.
- MACDONALD, S. D. 1970. The breeding behavior of the Rock Ptarmigan. Living Bird 9:195–238.
- MAXSON, S. J. 1977. Activity patterns of female Ruffed Grouse during the breeding season. Wilson Bull. 89:439–455.
- MAY, T. A., AND C. E. BRAUN. 1972. Seasonal foods of adult White-tailed Ptarmigan in Colorado. J. Wildl. Manage. 36:1180–1186.
- MCCOURT, K. H., D. A. BOAG, AND D. M. KEPPIE. 1973. Female Spruce Grouse activities during laying and incubation. Auk 90:619–623.
- NICE, M. M. 1957. Nesting success in altricial birds. Auk 74:305–321.
- SCHLADWEILER, P. 1968. Feeding behavior of Ruffed Grouse females. J. Wildl. Manage. 32:426–428.
- SCHMIDT, R. K., JR. 1969. Behavior of White-tailed Ptarmigan in Colorado. M.S. Thesis. Colorado State Univ., Fort Collins.
- WATSON, A. 1972. The behavior of the ptarmigan. Brit. Birds 65:6–26, 93–117.
- WATSON, A., AND D. JENKINS. 1964. Notes on the behavior of the Red Grouse. Brit. Birds 57:137–170.

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RENESTING OF WHITE-TAILED PTARMIGAN IN COLORADO

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Renesting by free-ranging grouse has rarely been documented and few references discuss the importance of renests to chick production. Bump et al. (1947: 364) failed to document specific instances of renesting in Ruffed Grouse (*Bonasa umbellus*) although they estimated that 12% of all broods resulted from renestings. Zwickel and Lance (1965) documented renesting in Blue Grouse (*Dendragapus obscurus*); Maxson (1977) provided evidence of renesting by Ruffed Grouse; Choate (1963:113) described renesting by White-tailed Ptarmigan (*Lagopus leucurus*) in Montana.

During 12 years (1966-1977) of intensive research on White-tailed Ptarmigan in Colorado we found two instances of renesting and have data available to estimate its importance to chick production.

STUDY AREA AND METHODS

Breeding and brood surveys were conducted annually along Trail Ridge Road in Rocky Mountain National Park, Colorado, from 1966 through 1977. A complete description of this study area is provided by Braun and Rogers (1971). We located breeding pairs in spring and broods in summer with tape recorded calls (Braun et al. 1973). Field techniques, including the capture and marking of birds, have been described by Braun and Rogers (1971) and Giesen (1977). Each year essentially the entire breeding population was banded prior to nesting and chicks were captured and marked when first found.

RESULTS AND DISCUSSION

We observed two hens reneest in 1975. On 18 June 1975 the first nest of hen G84 was discovered as she was laying her second egg. By 26 June the nest contained a complete clutch of five eggs and incubation had begun. The hen was incubating on 29 June when the nest was checked at 16:10. This nest was destroyed by a coyote (*Canis latrans*) prior to 11:15 on 6 July. Hen G84 was next seen on 16 August with a brood of eight chicks, four of whom were marked. These four (known to be 25 days of age) were the survivors of a brood in which the hen had been killed. The four unbanded chicks were estimated to be nine days old based on plumage characteristics (Giesen and Braun 1979). Hen G84 may have adopted all eight chicks. However, no known broodless hens were later seen with broods. We calculated that hen G84 began renesting three to nine days after losing her first

clutch, based on a laying interval of 1.5 days/egg and an incubation length of 23 days.

The nest of hen BW27 was found on 23 June when the first of six eggs was being laid. By 1 July incubation had begun. When the nest was checked on 6 July the clutch had been destroyed by a weasel (*Mustela* sp.). Hen BW27 was next observed on 14 September with a brood of three chicks. We captured the chicks and estimated that they were 37 days old. Renesting must have begun four to nine days after loss of the first clutch. Recrudescence of ovarian follicles to ovulation stage in nine days has been demonstrated for Blue Grouse (Hannon 1978).

Between 1966 and 1977 we noted at least 156 marked broods in Rocky Mountain National Park and identified 18 broods (11.5%) that probably resulted from renesting. Our criteria for determination of renesting were smaller brood sizes (2-5 chicks at hatch) and hatching dates more than 15 days later than the median hatch date for a given year. One renesting hen abandoned her mate and nested in the territory of another male. All original nesting attempts we have observed (n = 58) have been within the territory of the hen's mate.

We believe renesting occurred in at least 8 of 12 years. Renesting occurred in both "early" and "late" years based on a 12-year median hatch date of 15 July. In the "earliest" year (1977) the median hatch date was 6 July and 3 of 25 broods (12%) apparently resulted from renesting. In a "late" year (1975) the median hatch date was 22 July and 6 of 23 broods (26%) apparently resulted from renesting. Both adult (2+ years) and yearling hens renested, with adults being more successful in both initial and second nesting attempts (Braun and Rogers 1971).

Although renests accounted for 11.5% of all broods seen in Rocky Mountain National Park between 1966 and 1977, they accounted for only six percent of the chicks surviving until 30 September. This was due to the smaller average clutch size of renests (3.6 eggs vs. 5.9 eggs for initial clutches). Chick mortality prior to 30 September was similar for all broods (30-40%). Long-term survival for progeny of renests was difficult to calculate due to small samples, dispersal of juveniles (especially females) off the study area, and high mortality of chicks (60-70%) during their initial year of life. We know of at least two progeny of renests which survived to breeding age (10-12 months).

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