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RENESTING BY SAGE GROUSE IN SOUTHEASTERN IDAHO[1]

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Renesting in Tetraonidae has been investigated in a number of studies (e.g., Patterson 1952, Zwickel and Lance 1965, Giesen and Braun 1979, Parker 1981, Bergerud 1988, Bergerud and Gratson 1988). Unfortunately, information on renesting by Sage Grouse (*Centrocercus urophasianus*) is limited and highly variable. Both Patterson (1952:105) and Eng (1963) reported that renesting by Sage Grouse is relatively rare (<10%). However, Bergerud (1988) suggested that renesting rates by this species exceed 40%, based on a synthesis of the literature and Petersen's (1980) report that 7 of 17 (41%) radio-marked Sage Grouse renested.

The relative vulnerability of nests and life expectancy of the female may strongly influence renesting rates in grouse (Bergerud and Gratson 1988). Bergerud and Gratson (1988) argued that if predators are active near a Sage Grouse nest, the probability of nest loss is high because of relatively sparse cover. Thus, nest abandonment and renesting would be an advantageous strategy for this species. However, grouse with long life expectancies should renest less often than shorter lived species (Bergerud and Gratson 1988) and yearlings should renest less often than adults (Bergerud 1988). Sage Grouse have relatively long lives (Patterson 1952, Bergerud 1988) which, therefore, should result in lower renesting rates than other grouse species. The objectives of this study are to document renesting rates by Sage Grouse in Idaho and to test the hypotheses that yearling and adult Sage Grouse nest and renest at the same rates.

STUDY AREA

The study was conducted on the Big Desert of the Upper Snake River Plain and in the Curlew Valley, in southeastern Idaho. Topography of the Big Desert is flat to gently rolling with frequent lava outcrops. Annual precipitation averages 23 cm, with 40% falling from April through June. The area is dominated by a sagebrush (*Artemisia tridentata*/bluebunch wheatgrass [*Agropyron spicatum*]) habitat type (Hironaka et al. 1983). Some portions of this area have been burned within the last 12 years but most contain native stands of sagebrush. The area is described in more detail by Wakkinen (1990).

The Curlew Valley is about 90 km south of the Big Desert and consists of a sagebrush dominated valley and foothills. Annual precipitation varies from 28 to 36 cm. Mountain big sagebrush (*A. t. vaseyana*) and

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TABLE 1. Nesting and renesting rates by radio-marked yearling and adult Sage Grouse in southeastern Idaho, 1986–1992.

Age	No. birds[a]	No. nesting[b]	Unsuccessful[c]	Renesting
Yearling	97	53 (55%)[d]	25 (47%)	3 (12%)
Adult	145	113 (78%)	54 (48%)	9 (17%)
P-value[e]		0.001	0.95	0.65
Total	242	166 (69%)	79 (48%)	12 (15%)

[a] Number of Sage Grouse followed through the nesting season.
[b] Known Sage Grouse nest attempts.
[c] Only those birds that attempted to nest were considered in the calculations.
[d] Percentages in parentheses.
[e] Statistical comparisons are only made between yearlings and adults.

basin big sagebrush (*A. t. tridentata*) are common (Winward and Tisdale 1977). The shrub community also contains bitterbrush (*Purshia tridentata*), snowberry (*Symphoricarpus oreophilus*), and wild cherry (*Prunus* spp.).

METHODS

Field work was conducted from 1986 through 1992. We captured Sage Grouse by night-lighting (Wakkinen et al. 1992) on and near leks during March and early April. Birds were fitted with solar or battery-powered transmitters attached to ponchos (Amstrup 1980). The radio package (transmitter and poncho) weighed less than 20g. All grouse were also marked with numbered aluminum leg bands. Radio-marked females were monitored throughout the nesting season, but we did not purposely flush or otherwise disturb nesting hens. We assumed that localized movements indicated a hen was nesting. However, to minimize nest abandonment caused by observers, we only checked the nest when we believed the hen had been incubating for at least two weeks.

After a hen ceased her nesting efforts, we classified the nest as either successful or unsuccessful. We considered a nest successful if ≥ 1 egg hatched. Membrane condition of the eggs (Klebenow 1969), condition of the nest site or visual observation of the hen with a brood were used to indicate nest fate.

We pooled data among years and from both study areas because of previously documented similarities in nest success and habitats (Connelly et al. 1991). We used a *G* test with a Williams correction factor (Sokal and Rohlf 1981) to compare nesting effort (the number of birds initiating a first nest), nest success, and renesting effort between yearling and adult hens. Differences were considered significant if $P \leq 0.05$.

RESULTS

We monitored 242 radio-marked hens during the breeding season from 1986 through 1992 (Table 1). Nesting effort (the number of birds known to initiate a nest) by adult females ($n = 145$) averaged 78% over seven years and was greater ($P = 0.001$) than that of yearlings ($n = 97$) which averaged 55%. Therefore, we reject the hypothesis that adults and yearlings nest at the same rate. Nest success between age classes was similar ($P = 0.95$) and averaged 52%. Twelve percent of the unsuccessful yearlings renested while 17% of the adults renested (Table 1). Thus, there was also no difference in renesting rates between age classes ($P = 0.65$), and we fail to reject the hypothesis that adults and yearlings renest at the same rate.

DISCUSSION

Bergerud (1988) suggested that most female Tetraonids nest as yearlings but some yearling Sage Grouse may not nest. Our findings indicate that as many as 22% of adult and 45% of yearling Sage Grouse hens do not nest each year and that adults nest at a considerably higher rate than do yearlings. However, nesting rates may have been higher than what we detected if some of the hens had their nests depredated before we could locate them (i.e., early in the laying period). If so, renesting rates would be even lower than we reported. Moreover, if yearlings are less successful in concealing their nests than adults as Bergerud (1988) argued, then a relatively high proportion of yearling nests may be lost early in the egg laying period and the difference in nesting effort between yearlings and adults would not be as large as we reported.

Wallestad (1975) indicated that in Montana adult Sage Grouse ($n = 13$ grouse) had higher nest success rates than yearlings ($n = 9$ grouse). Our results indicate that there is no difference in success rates between age classes and thus do not support Wallestad's (1975) conclusion.

Patterson (1952:103) and Eng (1963) suggested that renesting rates by Sage Grouse were relatively low (i.e., $<10\%$) compared to other Tetraonids. However, neither of these studies used radio-marked birds. In contrast, Bergerud (1988) indicated that renesting by Sage Grouse exceeds 40%. Bergerud's (1988) findings are based on a synthesis of the literature and included a relatively small sample of radio-marked birds ($n = 17$) as well as observations of late-hatched young. Our findings more closely agree with those of Patterson (1952) and Eng (1963). Although Petersen's (1980) work was based on a sample of 17 birds, 41% did renest. However, we believe Bergerud's conclusions are erroneous because he assumed 75% nesting success to calculate renesting effort. Bergerud (1988) reported that a synthesis of 12 Sage Grouse studies produced a nest success rate of 35%, less than half the value that he used to estimate the Sage Grouse renesting rate. In our study, nesting success averaged 52% and in other studies has ranged from 64% (Wallestad 1975) to 10% (Gregg 1991). Because of wide variations in nest success, we suggest that renesting rates of all bird species are best determined through empirical approaches.

Bergerud (1988) also indicated that yearling hens generally renested less often than adults. In our study, yearlings and adults did not renest at significantly different frequencies.

Several factors may explain the relatively low renesting rates of Sage Grouse in Idaho. Eng (1963) suggested that the timing of lek attendance by male Sage Grouse may influence renesting and that infertility may prevent the production of late broods. Alternatively, Bergerud and Gratson (1988) argue that renesting rates may be influenced by the life expectancy of the female and longer lived species will renest at lower rates than shorter lived species. Sage Grouse are long-lived com-

pared to other Tetraonids and the population in our study had an annual survival of 50–60% (J. W. Connelly, unpubl. data). Braun and Beck (1985) reported similar survival rates for Sage Grouse in Colorado. A third explanation for low renesting rates in Sage Grouse may be related to food availability for chicks. This species occupies a xeric environment compared to other North American Grouse. Females may have a relatively short time to successfully raise a brood and young that hatch later in the spring may have lower survival because dry conditions have reduced food supplies. The dependence of Sage Grouse broods on habitats containing insects and succulent forbs (Klebenow 1969, Connelly and Markham 1983) and long-distance migrations between seasonal ranges reported by Connelly et al. (1988) and Wakkinen (1990) lend support to this theory. These three explanations may not be mutually exclusive and deserve further empirical testing.

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