

NESTING OF THE SAGE THRASHER, SAGE SPARROW, AND BREWER'S SPARROW IN SOUTHEASTERN IDAHO

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ABSTRACT.—I examined the territory size, mating success, nest placement, nest development, and nesting success of the three passerine species restricted to the sagebrush (*Artemisia tridentata*) habitat in southeastern Idaho. Territories defended by male Sage Thrashers (*Oreoscoptes montanus*) were larger than those defended by either Sage Sparrows (*Amphispiza belli*) or Brewer's Sparrows (*Spizella breweri*). All but one of the territorial Sage Thrashers ($n = 19$) were successful in securing mates and nesting. Fifty-three percent of the territorial Sage Sparrows ($n = 30$) and only 23% of the displaying Brewer's Sparrows ($n = 30$) secured mates and nested. Thrashers nested either on the ground below sagebrush or in the branches of sagebrush plants. Brewer's and Sage sparrows nested only in the shrub canopy of sagebrush. Average incubation and nesting periods (rounded to the nearest whole day) for the Sage Thrasher, Sage Sparrow, and Brewer's Sparrow were 15 ($n = 9$) and 12 ($n = 7$) days, 14 ($n = 5$) and 10 ($n = 7$) days, and 11 ($n = 1$) and 9 ($n = 1$) days respectively. Sage Thrashers ($n = 49$) and Sage Sparrows ($n = 17$) had a similar probability of nesting success (0.45 and 0.40, respectively), while the Mayfield success rate for Brewer's Sparrows ($n = 7$) was only 0.09. Male Sage Sparrows that attracted mates had established larger territories than those that failed to mate. Brewer's Sparrows nested about 10 days later than the other species, which may have resulted in their lower nesting success, since nest site requirements of all species were similar.

The Sage Thrasher, Sage Sparrow, and Brewer's Sparrow are common passerine species nesting in the sagebrush-dominated habitat on the Snake River Plain in southeastern Idaho. Each of these is said to be almost completely dependent on the sagebrush environment for survival (Braun et al. 1976). Until recently (Trost et al. 1975, Schroeder and Sturges 1975, Reynolds 1978, Rich 1977, 1978, Reynolds and Rich 1978), the ecology of passerines restricted to this habitat had received limited attention (Bent 1948, Feist 1968, Miller 1968, Paine 1968, Walcheck 1970, and Best 1972). Nesting data have been reported for the thrasher but they are lacking or incomplete for the two sparrows. I present here my findings on the territory size, nest placement, incubation and nesting periods, and the nesting success of these three species.

MATERIALS AND METHODS

Most of the data were collected from mid-March to mid-July 1976 and 1977, in two 4-ha study areas on the Idaho National Engineering Laboratory (INEL) Site, approximately 48 km west of Idaho Falls, Bonneville Co., Idaho. These areas were about 12 km apart and located in sagebrush steppe habitat (Küchler 1964) dominated by big sagebrush (*Artemisia tridentata*; Harniss and West 1973). Data on nest placement and development of nests found elsewhere on the INEL Site were included, but territories were measured only on the two study areas. Reynolds and Rich (1978) pre-

sented preliminary data on the nesting ecology of the Sage Thrasher, which were gathered in 1976 on one of these study sites, plus an additional study area 25 km east of the INEL Site. Where appropriate, and unless stated otherwise, data from the present study were combined and presented with theirs in order to increase the sample size for this species.

Territories were mapped for displaying males of each species following the methods of Williamson (1964) and Wiens (1973), and territory sizes were calculated according to Reynolds and Rich (1978). I considered males to be territorial only after their territories had been mapped at least three times on successive days. Although territories change in size and shape during the breeding season, the data presented here represent the total area in which territorial displays were recorded for each singing male, and thus represent maximum territory size. Wooden stakes, 1.8-m tall and color-coded with plastic flagging, were placed at 50-m intervals in each study area to ensure accurate mapping of territories and nest sites.

Field investigators found nests by observing courtship, nest building, or food carrying behavior, or by flushing a bird from the nest. Birds were flushed by randomly searching the area or by two researchers dragging a 25-m rope with flagging material suspended from it across the top of the vegetation. Nests were examined at 1-3 day intervals. The condition of the nest and the number of eggs and/or nestlings present at each visit were recorded. Hatching for these species was, for the most part, synchronous. Incubation periods were recorded as the time in days elapsed between the date the last egg of a clutch was laid and hatching. Fledging also was generally synchronous, and nesting periods were measured as the number of days between hatching and fledging, recorded for each nest. Nesting success was calculated using the nest-day, egg-day, and nestling-day as units of exposure (Mayfield 1975),

TABLE 1. Nest development and nesting success of the Sage Thrasher, Sage Sparrow, and Brewer's Sparrow in southeastern Idaho, 1976 and 1977.

Nesting parameter	Sage Thrasher ¹	Sage Sparrow ¹	Brewer's Sparrow ¹
Clutch size			
$\bar{x} \pm SD$ (n); range	3.5 \pm 0.8 (38); 1-5	2.8 \pm 0.4 (13); 2-3	3.4 \pm 0.5 (7); 3-4
Incubation period (days)			
$\bar{x} \pm SD$ (n); range	15.0 \pm 1.3 (9); 13-17	14.2 \pm 1.6 (5); 13-16	11.0 \pm 0.0 (1); 11
Hatching rate (%) ²	92	90	100
Hatchlings per nest ³			
$\bar{x} \pm SD$ (n); range	3.4 \pm 0.6 (35); 1-4	2.6 \pm 0.7 (11); 1-3	3.3 \pm 0.5 (5); 3-4
Nestling period (days)			
$\bar{x} \pm SD$ (n); range	12.3 \pm 1.3 (7); 11-14	10.0 \pm 0.8 (7); 9-11	9.0 \pm 0.0 (1); 9
Fledglings per nest			
$\bar{x} \pm SD$ (n); range	2.2 \pm 1.2 (45); 0-4	1.3 \pm 1.3 (15); 0-3	0.5 \pm 1.2 (6); 0-3
Successful nests (%) ⁴	69	56	14
Probability of success (Mayfield 1975)	0.45	0.40	0.09

¹ Values of n differ throughout each column because nests were located at different stages of development.

² Eggs lost during egg laying or incubation not included.

³ Includes only those nests surviving to hatching.

⁴ Nests fledging at least one young.

with the resulting statistic being the probability that an egg laid would produce a fledged young.

The height of the sagebrush containing a nest and the height of the nest (ground to bottom of nest) within the plant were measured after the nesting season. The distance from the rim of the nest to the crown of the plant and the canopy coverage were determined. The canopy coverage (CC) for shrubs containing nests was calculated using the formula:

$$CC = 3.14 \left(\frac{D_1 + D_2}{4} \right)^2$$

where D_1 was the diameter of the long axis of the canopy, and D_2 bisected and was perpendicular to D_1 (Mueller-Dombois and Ellenberg 1974). One-way analysis of variance followed by the Newman-Keuls multiple range test (Zar 1974) was used to compare differences in the nest site variables among the nesting species. The level of significance for statistical tests was $P < 0.05$.

RESULTS AND DISCUSSION

MATING SUCCESS AND TERRITORY SIZE

Sage Thrasher. Forty-nine Sage Thrasher nests were found during the study. Data on

nest development and production are given in Table 1, while Table 2 shows nest site characteristics. Reynolds and Rich (1978) found an average territory size of 0.96 ± 0.12 ha for seven territorial males mapped on one of the INEL Site study areas in 1976. Combining this value with my data on the other INEL study site from the same year yielded an average 1976 territory size of 1.14 ± 0.36 ha for 11 males. This was significantly smaller than the average of 1.86 ± 0.38 recorded for eight territories mapped in 1977. The difference in territory size, and hence nesting density, of Sage Thrashers between 1976 and 1977 may reflect the widespread drought in southeastern Idaho in 1977, the presence of Loggerhead Shrikes (*Lanius ludovicianus*) nesting in each study area in 1977 (Reynolds 1979), or localized and normal annual population fluctuations for the species. In 1976 one territorial male continued territorial displays

TABLE 2. Sagebrush nest-shrub characteristics and nest placement for the Sage Sparrow, Brewer's Sparrow, and ground- and branch-nesting Sage Thrashers in southeastern Idaho, 1976 and 1977. Values represent $\bar{x} \pm SD$ (n).¹

Shrub characteristic	Sage Thrasher ground ²	Sage Thrasher branch ²	Sage Sparrow	Brewer's Sparrow
Height of nest shrub (cm)	68 \pm 10 (28), A	89 \pm 17 (19), B	66 \pm 19 (16), A	65 \pm 9 (7), A
Canopy coverage of nest shrub (m ²)	0.39 \pm 0.15 (10), A	0.70 \pm 0.21 (12), B	0.35 \pm 0.16 (16), A	0.25 \pm 0.06 (7), A
Nest height (cm)	0 \pm 0 (28), A	18 \pm 9 (19), B	18 \pm 7 (16), B	25 \pm 8 (7), C
Nest-to-crown distance (cm)	59 \pm 10 (28), A	58 \pm 14 (19), A	43 \pm 14 (16), B	36 \pm 5 (7), B

¹ Data in each row followed by a different letter are different ($P < 0.05$).

² Includes some previously reported data (Reynolds and Rich 1978).

throughout the entire nesting season, and thus was considered unsuccessful in securing a mate. In 1977 all territorial Sage Thrashers mated.

Sage Sparrow. Nesting data were obtained from 17 Sage Sparrow nests (Table 1). Two of the seven nests (29%) located during the incubation period were abandoned after Brown-headed Cowbirds (*Molothrus ater*) parasitized the nests. The average incubation period for the remaining five nests (14.2 days) was slightly, but not significantly, longer than the 13-day mean reported by Miller (1968). Territories were mapped for 30 displaying males. Although vigorous encounters between males were observed at "territorial boundaries," more often than not adjacent territories overlapped and the line of defense changed daily. Fourteen males (47%) were unsuccessful in securing mates. While the other 16 males had, for the most part, ceased territorial displays after young hatched, these 14 continued singing from perches, presumably to attract mates, throughout most of the nesting season. Territory sizes for successful and unsuccessful birds did not differ significantly between 1976 and 1977. These annual data were pooled, yielding average territory sizes of 0.81 ± 0.21 ha and 0.70 ± 0.18 ha for successful and unsuccessful males respectively. These were significantly different (t-test) and may indicate that a male requires a minimum territory size (= territory quality?) in order to successfully attract a mate.

Brewer's Sparrow. Thirty Brewer's Sparrows established territories in the study areas, but only seven (23%) of these nested. Fourteen unsuccessful males abandoned their territories after defending them for less than three weeks; these may have been wandering birds. The nine other unsuccessful males remained on territory for most of the nesting season. No differences were found between the territory sizes for successful and unsuccessful birds either year. The overall territory size for the 30 Brewer's Sparrows was 0.52 ± 0.15 ha. Nesting data for this species were collected from 10 nests, three of which were distant from the main study areas and were monitored only at irregular intervals. The fate and success, of these three nests was unknown. Only two nests were found during the egg-laying period, one of which was abandoned after being parasitized by a Brown-headed Cowbird. The other was the only nest of the seven (14%) for which data on nesting success were available, that produced fledglings.

Rich (unpubl. data) found a similarly low success rate for Brewer's Sparrows on the Snake River Plain 25 km east of the INEL Site, with one of eight nesting pairs (12.5%) fledging young. The reasons for this extremely low rate of nesting success are unknown, and are currently being studied by other investigators on the INEL Site.

NEST PLACEMENT

Sage Thrashers built nests either on the ground below sagebrush or in the branches near the main axis of the plant. No second nesting attempts were recorded for this species on the INEL Site in 1976. In 1977 there was a nearly three-week hiatus between the hatching dates for first and second nests (4–22 May and 12 June–14 July, respectively). Ground-nesting Sage Thrashers accounted for 10 of 18 first nesting attempts and 2 of 4 second nests on the INEL Site. The relationship between nest placement and breeding time, and the concomitant advantage of a cooler location for elevated second nests suggested by Rich (1978), was not noted in this study. Ground-nesting and branch-nesting Sage Thrashers were treated separately for all nest site comparisons (Table 2). Sage Sparrows and Brewer's Sparrows both nested in the canopy of sagebrush plants. Sage Sparrows characteristically nested nearer the main stalk of the plant while Brewer's Sparrows nested in the outer branches.

I found no correlation between nesting success and any of the nest-site parameters. While Sage Thrashers and Sage Sparrows had high rates of nesting success on the INEL Site study areas in 1976 (86% and 100% respectively), only one of six Brewer's Sparrow nests was successful in fledging young. In 1977, Loggerhead Shrikes scuttled the reproductive efforts of all three species (Reynolds 1979). No young were fledged by either sparrow species, and only one pair of Sage Thrashers produced fledglings.

Branch-nesting Sage Thrashers selected larger sagebrush for nesting than did ground-nesting thrashers and both sparrow species. The latter three placed nests in plants with the same general physical characteristics (viz. shrub height and canopy coverage), but selected different elevations within the plant for the nest. As previously reported (Reynolds and Rich 1978), although nests of branch- and ground-nesting Sage Thrashers were placed at different heights within different-sized nest-shrubs,

the distance from the nest to the crown of the shrub was similar. Calder (1973) found that the volume or density of vegetation over a nest is of considerable importance in controlling the thermal environment of nesting hummingbirds. The consistency in nest-to-crown distance between both groups of Sage Thrashers suggests there may be an optimal amount of vegetation above the nest, having a thermoregulatory function.

While the onset of nesting activities for all three species was nearly three weeks later in 1977 than in 1976, the hatching sequence was the same. Sage Thrashers and Sage Sparrows generally hatched within a few days of one another, and Brewer's Sparrows hatched 10 or more days later. Most Brewer's Sparrows were just beginning to search for nest sites when the other species were already on the nest. This circumstance and the similarity of nest shrubs selected by ground-nesting birds of all three species suggest that the low success of territorial Brewer's Sparrows in securing mates and nesting may be correlated with, or controlled by, the number of Sage Sparrows and Sage Thrashers nesting within the area.

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