Reproductive Ecology of the Sage Thrasher (*Oreoscoptes montanus*) on the Snake River Plain in South-central Idaho

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The Sage Thrasher (*Oreoscoptes montanus*) is an abundant and conspicuous breeding species throughout the Snake River Plain in south-central Idaho. The paucity of literature regarding this species reflects a lack of interest in this habitat, rather than indicating the Sage Thrasher's abundance or ease with which it may be studied. No published data on incubation time, nesting success, nesting density, territory size, or reproductive rates of the Sage Thrasher are available. This paper will address each of these deficiencies.

Sage Thrashers breed from southern British Columbia east to eastern Montana, south to northern Arizona, and west to California (Bent 1948). They nest in semi-arid plains and valleys dominated by sagebrush (*Artemisia* spp.), and have been called a "sagebrush obligate" almost exclusively dependent on the sagebrush environment (Braun et al. 1976). Nesting is typically between 1,300- and 2,000-m elevation, with the nest located 60–100 cm above ground in a sagebrush (Bent 1948). Sage Thrashers arrive on the Idaho breeding grounds in April (March arrival during this study) and leave in large groups by mid-September (Bent 1948). Bent states that each pair usually raises only one brood annually, but second broods have been reported. Generally 4–5 eggs are laid, and fledging requires 11–13 days (Killpack 1970). The Sage Thrasher's main foods are insects, including eggs and larvae. They have been documented as being particularly useful in controlling the Mormon Cricket (*Anabrus simplex*) and other grasshoppers (Knowlton and Harmston 1943).

Our data were collected incidental to two independent projects. One study area was a tract of ungrazed sagebrush that is a portion of the continuing Bureau of Land Management Twin Buttes Rehabilitation Project located 15 km northwest of Blackfoot, Bingham County, Idaho. This area will be referred to as the BLM area. The other area was also sagebrush-dominated, but has been grazed by sheep in the spring of each year for 20 yr. This tract is 1 km west of Atomic City, Bingham County, Idaho, and lies within the southern boundary of the Idaho National Engineering Laboratory Site, administered by the U.S. Department of Energy. This area will be termed the INEL study area.

The two areas are separated by a distance of approximately 25 km. Each is over 100 km^2. For both areas, the lithology is subrecent to recent lava flows, the topography is flat to gently rolling with infrequent lava outcroppings, and the elevation is just under 1,500 m. Each area receives less than 25 cm of precipitation annually, mostly in the form of spring rains.

Vegetative cover was determined in June and July 1976 with the canopy coverage method of Daubenmire (1959). Engineering stakes, 1.8-m tall, were placed at 50-m intervals in grids of 4 ha in the INEL area and 9 ha in the BLM site. Stakes were color-coded with plastic flagging to permit accurate mapping of nest locations and territory displays. Nesting territory size was determined for nesting pairs on the INEL area only. These territories were determined by mapping the singing perches of the males (Williamson 1964) augmented by the 20 flushes and mapping procedure used by Wiens (1973). Territory size for each nesting pair was determined by connecting the peripheral perches or flush points on a map of the study area, photocopying the map, cutting out the territory, weighing the territory with a Mettler balance, and computing the area from a standard area/paper weight relationship.

Sage Thrasher nests were located by either accidental flushing of a bird from a nest or by observing nest building, courtship, or food carrying behavior and then rigorously searching the area for the nest. Nests were rechecked at 1–3-day intervals. Nesting success was calculated using the nest day, egg day, and nestling day as units of exposure (Mayfield 1975). Data on nest position were gathered after the nesting season. The distances from the nest to the ground, height of sagebrush, and the distance to the next nearest nest were measured.

Thirty-four Sage Thrasher nests were located and followed closely until fledging. Thirteen of these nests were on the INEL study area, 21 on the BLM area. In the BLM area 15 nests were first nesting attempts and the remaining six were second nestings. No second nesting attempts were recorded on the INEL area.

Vegetation.—The BLM area (ungrazed) was by far the more diverse vegetationally, having a total of 28 identified vascular plant species (Table 1). The grazed INEL area had only nine plant species present. The average sagebrush height was 52 cm in the INEL area, but was not measured in the BLM area.

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TABLE 1. Canopy coverage vegetation summary of two study areas on the Snake River Plain (June and July 1976)

	INEL STUDY AREA		BLM STUDY AREA	
	% cover	% of total cover	% cover	% of total cover
Big sagebrush (*Artemisia tridentata*)	25.0	51.9	22.5	32.5
Squirreltail (*Sitanion hystrix*)	9.2	19.1	9.2	13.3
Rabbitbrush (*Chrysothamnus nauseosus*)	1.6	3.3	—	—
Sandberg's bluegrass (*Poa sandbergii*)	—	—	7.9	11.4
Contribution by the above species to total cover	74.4%		57.2%	
Total % cover, all species	48.1		69.1	
Number of species present	9		28	

Nest placement.—All nests were either in or under sagebrush. Of the 34 nests located during this study, 21 were ground nests. Twenty of these (95%) were first nests. Ground nests generally touched the main axis of the plant, in plants 55–90 cm tall ($\bar{X}$ = 70 cm ± 10 cm SD). The remaining 13 nests (eight of which were first nests) were located 10–40 cm above the ground ($\bar{X}$ = 24 cm ± 9 cm SD) in sagebrush 75–115 cm tall ($\bar{X}$ = 90 cm ± 14 cm SD). The mean height of sagebrush containing elevated nests and sagebrush with ground nests differed significantly when analyzed with the Mann-Whitney *U*-test, corrected for ties (Siegel 1956) [$P(z = 2.32) < 0.05$]. Elevated nests require taller sagebrush. However, the distance from the top of a sagebrush to an elevated or a ground nest was not significantly different [$P(z = 1.59) > 0.05$] and averaged 66 cm ± 16 cm SD. It thus appears that Sage Thrashers may select nest sites from the top of the sage downward, rather than from the ground level upward. This is to say, perhaps, that the volume or density of material shading or covering the nest is of considerable importance. Five of the six second nests (83%) were elevated nests, perhaps indicating that during the second nesting period the nests are placed above ground level to decrease predation and/or decrease heat conduction from the ground or increase convective heat loss from the nest via increased air circulation. Nonetheless, the distance from the nest to the crown of the sagebrush remained constant between first and second nesting periods, possibly affording the same protection from direct solar radiation through the nesting season.

The mean distance from one nest to the next nearest nest was 63.6 m ± 11.6 m SD in the BLM area and 84.3 m ± 15.8 m SD in the INEL area. These distances are significantly different when tested by the Mann-Whitney *U*-test (P ($U \leq 17$) = .05). The demonstrated differences in distance to the next nearest nest can also be interpreted as differences in nesting density, reflecting differences in the nesting habitats. These differences are probably related to unequal grazing pressures or differences in plant species diversity, and may correlate with differential insect availability between the two areas.

Territory size.—Territory sizes on the INEL study area averaged 0.96 ha ± 0.12 ha SD (n = 7) with a range of 0.64–1.64 ha. The largest territory was overlapped by territories of two adjacent pairs. This may indicate there is an upper limit to the size of a territory that a Sage Thrasher may completely defend from neighboring birds.

Nesting success.—Because we found a significantly greater nestling loss than egg loss (χ^2 = 18.03, $P < .001$), we partitioned success rates into the probabilities of nest success during incubation and nestling periods, egg success, and nestling success (Table 2). The product of these categories multiplied by the hatching rate (number of eggs incubated divided by the number of eggs hatched) equals the probability that an egg will survive to produce a fledged young (Mayfield 1975). This probability was 0.51 for the INEL area and 0.43 for the BLM area (Table 2). Combining nesting data resulted in a nesting success probability of 0.46 for both areas.

The four Sage Thrasher nests located before egg-laying commenced had incubation times of 14, 14, 15, and 17 days (mean = 15 days). During incubation no eggs or nests were lost on the INEL study area. In the BLM area, however, two nests with one egg each were deserted. One of these deserting pairs was known to have renested 20 m from the original nest site. The fate of the other deserting pair is unknown.

The average clutch size and number of young fledged from a successful nest (a nest fledging at least one bird) were 4.0 (n = 7) and 2.8 (n = 11) respectively in the INEL area, and 3.3 (n = 21) and 2.5

TABLE 2. Nesting success of the Sage Thrasher on the Snake River Plain

	Study area		
	INEL	BLM	Combined
Nest Success			
Incubation period	1.00	0.78	0.85
Nestling period	0.79	0.92	0.86
Egg Success	1.00	1.00	1.00
Hatching Rate	0.89	0.95	0.93
Nestling Success	0.72	0.64	0.68
Probability of an egg producing a fledged young	0.51	0.43	0.46

(n = 19) in the BLM area. These data do not differ significantly. There was, however, a significant difference [$P(U = 66.6) < 0.01$] in the size of the first and second clutches on the BLM site ($\bar{X} = 3.8$ and 3.2 respectively). Combining all clutch size and nestling data gives a mean clutch size of 3.5 (n = 28) and a mean number of fledged young per successful nest of 2.6 (n = 30).

We thank Dr. Charles H. Trost, Doug Shorey, and Mary Reynolds for assistance in locating nests on the INEL study area. Data on the BLM area were collected incidental to a study supported by the Frank M. Chapman Memorial Fund of the American Museum of Natural History. This is a contribution from the INEL Site Ecological Studies Program, supported in part by the Division of Biomedical and Environmental Research, Department of Energy.

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Received 12 April 1977, accepted 3 July 1977.

Mice as a Source of Egg Loss Among Ground-nesting Birds

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Although large rodents such as ground squirrels and rats have frequently been mentioned as predators of ground-nesting birds, the few documentations of loss of eggs or young to small rodents are largely from arctic locations (Wynne-Edwards 1952; Sutton and Parmelee 1954, 1955; Parmelee and MacDonald 1960; Parmelee *in* Bent 1968; Custer and Pitelka, 1977). Criddle (*in* Bent 1968), speaking of temperate grasslands, reported Baird's white-footed mouse (*Peromyscus maniculatus bairdii*), Drummond's vole (*Microtus pennsylvanicus drummondi*), and thirteen-lined ground squirrels (*Spermophilus tridecemlineatus*) as frequent raiders of passerine nests.

We have been studying Spotted Sandpiper (*Actitis macularia*) behavior on Little Pelican Island (1.6 ha), Leech Lake, Cass County, Minnesota since 1972 (Oring and Knudson 1972, Heidemann and Oring 1976, Oring and Maxson in press). *Microtus pennsylvanicus*, *Peromyscus maniculatus*, and *Clethriono-*