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).

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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-*

mys gapperi are the resident mammals on this island. Occasional visits of mink (*Mustela vison*) are detected easily by tracks on the beach. Our studies involve spending over 5,000 man-h per year on the island. We observed birds and/or nests from 3-m towers during six or more randomly-selected 45-min periods virtually every day of the breeding season.

Oring and Knudson (1972) noted that many clutches contained fewer eggs than the normal clutch of four. Subsequently it became apparent that this was due to "predation" typified by overnight damage to one egg of a clutch. Occasionally two eggs were damaged the same night. Eggs sometimes disappeared altogether (twice a parent sandpiper was seen flying off with a damaged egg), sometimes were rolled up to 1 m from the nest, and sometimes remained in the nest. Each damaged egg had two small punctures (similar in diameter to mouse incisors) about 8 mm apart. Mouse droppings were commonly found near the nests. Surprisingly, these eggs were not eaten. Sometimes albumin leaked from the punctures but often no leakage occurred. None of the damaged eggs hatched.

Spotted Sandpipers typically began overnight incubation after the third egg was laid. Prior to incubation onset (1975–77) a total of 20 eggs was damaged during 191 clutch-nights. During 1,085 clutch-nights after incubation began only 29 eggs were damaged. This difference was significant ($\chi^2 = 70.4$, d.f. = 1, $P < 0.005$), indicating that eggs were afforded a moderate degree of protection from mice once they were attended at night by a parent. On several occasions incubating sandpipers were observed vigorously chasing *Microtus* that wandered close to nests in the daytime.

Table 1 summarizes egg loss due to mice during 1975–77. In 1975 the percentage of eggs lost to mice was relatively low due largely to heavy mink predation (about 120 sandpiper eggs) that decreased availability of eggs to mice. For example, in 1975 the average clutch (starting when the first egg was laid) was available to mice only 8.7 nights. In 1976–77 when no mink were present, clutches were available an average of 19.5 and 19.2 nights. The mink probably further reduced egg loss to mice in 1975 by actively preying on mice.

In 1976, three of the first four clutches laid had two to three eggs punctured by mice and were deserted. We began live-trapping mice in the vicinity of nests on 31 May 1976 and continued until 14 June. Ten to 12 traps were set each night totaling approximately 150 trap-nights. Forty-five *Peromyscus*, 3 *Microtus*, and no *Clethrionomys* were removed from an area totaling 0.25 ha. Most mice were caught in the first week of trapping. Subsequently, 11 additional clutches were laid. None of these clutches was lost although one egg was damaged late in the season. Thus, once *Peromyscus* were severely reduced, egg damage essentially ceased. *Microtus* continued to be abundant throughout the summer and were occasionally seen near nests in the daytime yet no additional egg damage occurred.

In 1977 we trapped a total of 89 trap-nights between 11 May and 21 June. Thirteen *Peromyscus*, 6 *Microtus*, and 2 *Clethrionomys* were captured. No *Peromyscus* were captured after the second night of trapping. Thus, we believe that *Peromyscus* were totally eliminated from the island before any eggs were laid but *Microtus* remained abundant. Subsequently, 61% of the nests were "depredated" by mice to some extent, resulting in hatching failure of 34% of the eggs.

These data strongly implicate *Peromyscus* as being responsible for egg damage in 1976 and *Microtus* in 1977. *Clethrionomys* were not as abundant as the other two species and occupied habitats containing very few nests. We are unsure why *Microtus* did not damage eggs in 1976 after *Peromyscus* were removed. Prior to our trapping, *Peromyscus* may have excluded *Microtus* from habitats containing most sandpiper nests. In addition, high water levels in 1975 flooded 20–40% of the island throughout the summer while in 1976–77 these areas were dry, contained dense herbaceous growth, and were preferred habitats for *Microtus*. In 1976, at the time *Peromyscus* were reduced, the *Microtus* population may have been expanding into previously flooded preferred habitats and hence did not immediately move into the more open areas vacated by *Peromyscus*. In 1977, after virtually no predation on or trapping of *Microtus*

TABLE 1. Summary of Spotted Sandpiper egg loss due to mice

Year	Total nests	Nests "depredated" by mice		Total eggs laid	Eggs damaged by mice		Total eggs not hatching due to mice[a]	
		No.	%		No.	%	No.	%
1975	45	6	13	156	8	5	10	6
1976	15	4	27	60	9	15	13	22
1977	31	19	61	116	32	28	40	34

[a] Includes undamaged eggs deserted after partial "depredation" of clutch

the previous summer, population pressures probably forced them into areas previously occupied by *Peromyscus*, thereby increasing encounters with sandpiper nests.

P. maniculatus and *M. pennsylvanicus* are relatively abundant throughout most of temperate North America. In our opinion they are potentially a major cause of nest loss in patches of highly productive, two-dimensional habitat where dense mouse populations overlap areas of nest clustering. Ornithologists studying small ground-nesting birds in such areas should be alert to the possibility of small rodents causing loss of eggs.

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Fratricide and Cannibalism in Swainson's Hawk

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Pilz (1976, Auk 93: 838) reported a probable case of fratricide and cannibalism in Swainson's Hawk (*Buteo swainsoni*) based on observations made during a food habits study in 1974. In 1975 a second instance was observed, in which a nestling was actually seen to kill and eat a nest mate.

The study was conducted 40 km NNE of Las Cruces, New Mexico. The nest was in a tall multi-branched yucca (*Yucca elata*) and situated in a fork about 2.5 m above the ground. There were four young in this nest, the largest brood recorded in 31 nests studied during 1974 and 1975. The youngest nestling was 30 days old on 10 July 1975 and its nest mates were 33, 34, and 35 days old. The youngest hawk was less than half the size of its oldest nest mate and looked emaciated.

On 10 July while collecting food samples from the nestlings, L. K. S. observed the oldest nestling standing on the bleeding head of the youngest nest mate, and immediately went to another nest to inform W. R. P. When we arrived back at the nest the youngest hawk was dead and the oldest nest mate was tearing flesh off the neck and eating it. All of this time the two other nest mates were at the opposite end of the nest. When we returned to the nest that evening, no remains of the young bird were found in the

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