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SITE FIDELITY AND RENESTING OF FEMALE AMERICAN PIPITS

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Abstract.—Nesting biology of American Pipits (*Anthus rubescens*) was studied on the Beartooth Plateau in northern Wyoming in 1987–1989, with supplemental observations made in 1984. Thirty-two adult female pipits were banded in 1987 and 1988. Return rate of banded females for the first year following banding was 12.5% (4 of 32 females); 1 (6.3%) of 16 females banded in 1987 was also found nesting on the study area in 1989. Nests of returning females were close (<40 m) to their nests of the previous year, or were off the study area. Four cases of within-year renesting were documented. Replacement nests were close (36.8 ± 14.5 m) to original nests, and the first replacement eggs were laid 5.5 ± 1.3 d after original nests were destroyed or abandoned. On average, replacement clutches were as large as original clutches, but mean egg volumes were slightly smaller in replacement clutches.

FIDELIDAD A LOCALIDADES Y REANIDAMIENTO EN HEMBRAS DE *ANTHUS RUBESCENS*

Sinopsis.—La biología de anidamiento de *Anthus rubescens* se estudió en la localidad de Beartooth Plateau, al norte de Wyoming. El estudio se llevó a cabo de 1987–1989 con observaciones suplementarias en el 1984. Se anillaron 32 hembras adultas en 1987 y 1988. La tasa de retorno de hembras anilladas para el primer año fue de 12.5% (4 de 32); el 6.3% (1/16) de las hembras anilladas en el 1987 también regresaron al área de estudio a reproducirse. Los nidos de estas hembras, se encontraron tanto cerca (<40 m) de sus nidos del año anterior, como fuera del área de estudio. Cuatro casos de reanidamiento fueron documentados al año siguiente. Ocurrió remplazo de camadas 5.5 ± 1.3 d luego de que el nido original fuera destruido o abandonado. Las camadas de remplazo fueron, en promedio, tan grandes como las camadas originales, pero el volumen promedio de los huevos en éstas, fue un poco menor.

A comprehensive study of the breeding ecology of the American Pipit (*Anthus rubescens*; formerly *A. spinoletta*) exists in the literature (Verbeek 1970), yet many details of pipit breeding biology remain poorly documented and understood. This can be particularly frustrating when attempting comparisons of passerine breeding biology in arctic and alpine habitats, where the American Pipit nests. Here, I document and discuss site fidelity and renesting by female American Pipits nesting in alpine habitat, topics about which few data exist.

STUDY SITE AND METHODS

Field work was conducted at a study site on the Beartooth Plateau, Park County, Wyoming (just below Beartooth Pass), encompassing about 120 ha of alpine terrain. Elevations in the study area were 3100–3300 m. The Beartooth Mountains comprise a series of large alpine plateaus with extensive tundra development. Consequently, there is a large breeding population of American Pipits present, making the area particularly

well suited for breeding studies of this alpine bird. Verbeek's (1970) pioneering study of pipit breeding ecology was conducted at this same site.

The data presented in this paper were collected primarily during the summers (June–August) of 1987–1989; observations from 1984, made incidental to a previous study of foraging ecology and habitat use (see Hendricks 1987a,b), are also included. Female pipits were captured on their nests with a butterfly net, and individually marked with aluminum and colored plastic leg bands. The study site was traversed daily. Nests, once located, were checked daily to follow the sequence of nesting events and to measure eggs. Linear dimensions of eggs were measured to the nearest 0.1 mm with a dial caliper. Egg volumes were calculated using Hoyt's (1979) equation

$$V = 0.507LB^2,$$

where V = egg volume, L = maximum length, and B = maximum breadth. Statistical procedures follow Sokal and Rohlf (1981), with significance level set at 0.05. Dispersion around mean values is given as $\bar{x} \pm SD$ throughout the paper.

RESULTS

During 1987–1989 32 adult female American Pipits were banded (16 in 1987 and 16 in 1988) and 168 pipit nests were located. In 1984 six females were banded and 12 nests were found. Nest predation rates were probably artificially high in 1988 and 1989 as a result of a pair of Common Ravens (*Corvus corax*) following my activities. Consequently, many of the nests I discovered were probably renesting attempts, but because most adult pipits were not banded I will discuss only resightings and renestings from my small sample of marked adults. My discussion refers only to activities of adult females; no adult males were captured and marked.

Annual return rate of adult females.—For all females banded in 1987 and 1988, 4 (12.5%) of 32 were resighted on the study area the year following banding (two each in 1988 and 1989). One of the females banded in 1987 (and found nesting in 1988) was also found nesting in 1989, a second year return rate of 6.3% for the 1987 cohort. These results, though scant, are similar to Verbeek's (1970) observations, where one (11.1%) of nine females marked in 1963 was resighted the following year. following year.

The resighted females in 1988 returned to the study area following unsuccessful nestings; the resighted females in 1989 (from the 1988 cohort) returned following successful nestings. The 1987 female resighted in 1989 successfully nested in 1988.

Nest-site fidelity of returned females.—Nests of two 1987 females (970-50654 and 970-50660) were found in 1988, 34 and 37 m, respectively, from their nest sites of the previous year. One of these females (970-50654) was found nesting in 1989, 24 and 38 m, respectively, from her 1987 and 1988 sites. Two additional females, banded in 1988, were

resighted briefly in 1989 near their 1988 nest sites, but were not found nesting on the study area. Verbeek (1970) reported one female nesting about 400 m from her nest site of the previous year.

Renesting.—I observed four cases of renesting by marked females: one in 1984 and three in 1988 (Table 1). Clutch size during renesting attempts showed no change in two cases, whereas the remaining two cases showed changes by one egg each, but in opposite directions. Replacement nests were located relatively close to original nests (mean inter-nest distance = 36.8 ± 14.5 m, $n = 4$), and first eggs appeared in replacement nests within a week ($\bar{x} = 5.5 \pm 1.3$ d) after the original nests were destroyed or abandoned. Egg volumes were only measured for the 1988 nests. In all three cases, mean egg volumes declined with renesting, but only in one case (female 970-50660) was the decline statistically significant ($t = 3.371$, df = 8, $P < 0.001$).

In 1988, in addition to the three renesting attempts, 13 other marked female pipits lost first nests and were not resighted. At least two of these females were probably killed, as indicated by the presence of pipit feathers at the destroyed nests. The remaining 11 marked females were either killed or left the study area if they renested.

DISCUSSION

Nest-site fidelity encompasses two distinct components: between-year fidelity and within-year fidelity (Greenwood and Harvey 1982). At least some female American Pipits display both types of site faithfulness.

Annual rate (12.5%) of return for female American Pipits to the Beartooth Plateau study site is low in the year following banding, relative to calculated rates of annual survival (about 45%) for adult Meadow Pipits (*A. pratensis*) in Europe (Coulson 1956, Seel and Walton 1979, Spaepen 1988), and annual return rate of male (52%) and female (32%) adult Tree Pipits (*A. trivialis*) in Switzerland (Meury 1989). This suggests the possibility that mortality is greater for female American Pipits, or else that a large proportion of female American Pipits may return to breed in areas some unknown distance from the site of breeding the previous year. Seel and Walton (1979) and Hötker (1988) suggested that once an adult female Meadow Pipit is settled on a territory, she tends to return to that territory (or nearby) to breed in subsequent years; Meury's (1989) data on Tree Pipits support this conclusion. Prairie Warbler (*Dendroica discolor*) females show a low initial (first year) return rate of 19%, similar to my value for female American Pipits, but Nolan (1978) suggested that his return rate is an underestimate of annual female survivorship. It remains to be determined if the low annual rate of return for female American Pipits is due to dispersal or mortality.

Renesting within a breeding season usually involves a change of nest site for most bird species (Greenwood and Harvey 1982). Nolan (1978) found that female Prairie Warblers will renest as far as 285 m from the site of the original nest, but the mean of 193 cases was 85 ± 53 m. For

TABLE 1. Comparison of original and replacement nests of American Pipits in the Beartooth Mountains, Wyoming.

Female band no.	Clutch size original (renest)	Egg volume (mm^3) original (renest)[a]	Renesting interval (d)[b]	Inter-nest distance (m)[c]
71-02299	5 (6)	—	6	20
970-50660	5 (5)	2463 ± 72 (2335 ± 45)	7	33
930-31865	6 (5)	2097 ± 61 (1997 ± 139)	5	39
930-31867	6 (6)	2232 ± 41 (2200 ± 112)	4	55

[a] $\bar{x}$ ± SD/clutch.
[b] Period between loss of first nest and appearance of first replacement (renest) egg.
[c] Linear distance between original and replacement nest.

the four renestings of female American Pipits I documented, the distance between the original and replacement nests was so close (36.8 ± 14.5 m) that renesting probably occurred on the original territory or in the large area of undefended space generally found adjacent to the territory (Hendricks 1987a, Verbeek 1970). It is possible, however, that as many as 11 of 16 (69%) female pipits renested a considerable distance from their original territories in 1988. Until more data are available, it seems premature to conclude that abandonment of the nest and territory usually go together for American Pipits (Verbeek 1970).

The breeding season of alpine-nesting American Pipits is compressed, with some breeding events overlapping (e.g., initiation of adult molt while young are still in the nest) (Verbeek 1970, 1973). There is sufficient time to renest if the nest is destroyed relatively early in the breeding season, though not enough time to raise two broods in any single year (Verbeek 1970, pers. obs.). If renesting occurs at the time female nutrient reserves are being mobilized for feather replacement, a possible result could be a reduction in the number or size of eggs laid.

I have no data on the status of molt for the female pipits that renested, but renesting occurred in late June and early July, prior to the normal onset of molt, which occurs in mid to late July (Verbeek 1970, 1973). The short period of time between loss of the original clutch and the appearance of the first replacement egg (Table 1) shows that female pipits are capable of quickly mobilizing the resources necessary to cover the losses of eggs or young. In three of four cases, female American Pipits laid replacement clutches of equal or larger size than original clutches, which is similar to replacement clutches of Meadow Pipits (Pedroli 1978). Mean egg volume was smaller in replacement clutches in each case where measurements were made (Table 1), but significantly so in only one of three cases. Because growth rate and survival of nestling birds are often positively correlated with egg size within species (see Martin 1987) it would be of interest to determine if renesting tends to result in a decline in mean egg size, and, if so, to identify any particular period of the breeding cycle when this effect might be most pronounced.

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