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NESTING LOSSES AND NEST SITE PREFERENCES IN HOUSE WRENS[1]

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Abstract. This study examined nest sites selection by a cavity nesting species, the House Wren (*Troglodytes aedon*), at two sites in Ontario, Canada. Descriptive information suggests that predation is the most important factor reducing House Wren reproductive success. Nests built in sparse vegetation suffered less predation than those in dense vegetation. Descriptive and experimental data demonstrated that House Wrens exhibit strong preference for nesting boxes in sparse vegetation, presumably because here they are more successful. We suggest that the greater success of House Wrens in sparse vegetation results from their more effective nest defense against other conspecifics that may attack wren nests. We predict that the ability of males to defend suitable nest sites influences their mating success.

Key words: House Wren; Troglodytes aedon; *nest site selection; predation; breeding success; vegetation density.*

INTRODUCTION

Differential success of nests placed in different sites presumably influences the evolution of species-specific patterns of nest placement (e.g., Best 1978, Evans 1978). Microclimate (Pleszcynska 1978, Palmgren and Palmgren 1939, Rich 1980, Bergstrom 1982, Zerba and Morton 1983), food supply (Zimmerman 1966, Verner and Engelson 1970, Holm 1973), and nest predation (Graul 1975, Murphy 1983, Nilsson 1984, Page et al. 1985) have been considered important variables influencing nest site selection. The relative importance of each variable is determined by its influence on nesting success (e.g., Austin 1974, Rich 1980, Garson 1980, Finch 1983).

The House Wren (*Troglodytes aedon*) is an insectivorous, double brooded, cavity-nesting passerine which occasionally mates polygamously (Kendeigh 1941). Males defend all-purpose territories centered around one or a few cavities (or nesting boxes). Territorial advertisement is, however, concentrated mainly to a single cavity. Extra nests may give females a choice between several nest sites (Kendeigh 1941).

It has been suggested that female House Wrens select mates on the basis of nest site qualities (Sherman 1925, Kendeigh 1941). If this is so, nest sites should vary in some quality(ies) that are important for successful breeding, and males should, if given an opportunity, exhibit a preference for these high quality nest sites. Bent (1948) suggested that House Wrens breed in cryptic cavities. Breeding in concealed cavities (i.e., in dense vegetation) may reduce chances of predation (e.g., Garson 1980, Murphy 1983) and moderate microclimate (Kendeigh 1963a). In this study, we examined nest site preferences in House Wrens by addressing the following questions: (1) What are the main causes of nesting losses in House Wrens? (2) Does vegetation density at nest sites affect reproductive success? and (3) Do male and female House Wrens choose nest sites accordingly?

METHODS

Data were collected during spring and summer 1985 at two locations in Ontario, Canada: Presqu'ile Provincial Park (PPP; 44°N, 78°W) and Mer Bleue Bog near Ottawa (MBB; 46°N, 76°W). Descriptive information on nest site selection and nesting success was collected at PPP and an experiment on nest site selection was conducted at MBB.

In late April at PPP, 92 identical boxes (11 × 14 × 20 cm, entrance diameter = 3 cm) were distributed along two transects separated by 25 m. Both transects ran through a deciduous forest (65 boxes) and adjacent sand dunes (27 boxes), the total area encompassing about 17 ha. Nest boxes faced southeast (see Stauffer and Best 1982), were approximately 1.5 m above ground, and were separated from each other by about 35 m. Boxes were attached to trees, or to 5 cm × 5 cm wooden poles in the absence of trees. The dominant tree species of the forest were red oak (*Quercus rubra*), white ash (*Fraxinus americana*), red maple (*Acer rubrum*), american beech (*Fagus grandifolia*), and hophornbeam (*Ostrya virginiana*). Ground flora was dense and diverse. In the dunes, eastern cottonwood (*Populus deltoides*), eastern white cedar (*Thuya occidentalis*), and eastern red cedar (*Juniperus virginiana*) dominated. The understory was limited to patches of common juniper (*Juniperus communis*).

Every second day, from early May to mid-August, we recorded nest contents at all boxes.

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To estimate vegetation density around nests, we positioned a 2 m stick with three 50 cm sticks attached perpendicularly in front of each box, and counted the number of red dots visible on the horizontal bars from a distance of 2 and 5 m from the box. The horizontal bars were attached at heights of 0.5, 1.0 and 1.5 m, and each had evenly spaced red dots (1 cm in diameter) painted on it. The sum of full circles seen at 2 and 5 m was used as an index of vegetation density (i.e., high dot count = low vegetation density). Vegetation density was measured in early July. We assume that relative differences in vegetation density between boxes did not vary throughout the season. All females settled after leaf emergence, therefore, the density estimates should be a reliable index of vegetation density at settlement. Because breeding attempts and breeding success are binary variables (e.g., success vs. failure) a logistic regression was used in the analysis (Dixon et al. 1981).

To test for the effect of vegetation density on House Wren nest site selection, 60 nest boxes identical to those used at PPP, were offered at MBB in early April, before wren arrival. Nest boxes also faced southeast and were erected 1.5 m above ground. Boxes were placed in groups of three, in a triangular pattern, 5 to 10 m apart, depending on the availability of trees. Within each group of three, one box was placed in each of what we perceived as sparse, medium, and dense vegetation. To verify our apprehension, in early July, we measured vegetation density using the technique described earlier. Boxes in dense and medium vegetation were attached to trees and those in sparse vegetation were fastened to 5 cm × 5 cm wooden poles. Territorial males could therefore defend three boxes that differed in the density of surrounding vegetation. Groups of boxes were separated by at least 60 m. The dominant tree species of this study site were speckled alder (*Alnus rugosa*), basswood (*Tilia americana*), pussy willow (*Salix discolor*), and choke cherry (*Prunus virginiana*). Ground flora was dense and dominated by Canada mannagrass (*Glyceria canadensis*), red-stalked aster (*Aster puniceus*), and Joy-pye-weed (*Eupatorium maculatum*).

All boxes were checked once a week and their contents noted. Male preference for certain nest sites was measured by the quantity of twigs present in nest boxes. We assume that the relative amount of nest material in boxes within a group reflects male preferences (see also Kendeigh 1941). Female selection was measured by nesting attempts (i.e., at least one egg in the nest regardless of subsequent fate). Following territory abandonment (e.g., after successful breeding), we emptied all three boxes in the group to allow for determination of nest site choice in later breeding attempts.

RESULTS

DESCRIPTIVE DATA ON REPRODUCTIVE SUCCESS AND NEST SITE SELECTION BY FEMALES

Male House Wrens at PPP advertised at 83 of the 92 available boxes (90.2%), and 62 (67.4%) were used by females. Fifteen boxes were used twice and thus, the total number of nesting attempts was 77. At PPP, 37 active nests (48.1%) failed to fledge any young. About 81% of nesting failures ($n = 30$) were due to predation (contents disappeared before the expected fledging date). Females abandoned seven nests, and starvation (presumably because of desertion by parents) accounted for one nesting failure. Nest success of boxes placed on poles did not differ significantly from that of boxes attached to trees ($\chi^2 = 0.05$, df = 1; $P > 0.75$). Nest support type, therefore, did not significantly affect wren nesting success.

Significantly more breeding attempts by females were made in boxes placed in sparse vegetation (logistic regression: B = 0.06, Z = 3.63; $P < 0.001$). Moreover, these boxes were more successful than those in dense vegetation (logistic regression: B = 0.13, Z = 2.81; $P < 0.001$). Most boxes in dunes were in sparse vegetation, attracted more breeding pairs, and averaged high reproductive success (only 3 of 23 nests failed to fledge any young).

To control for differences between habitats, we examined data for the forest separately. Results of this analysis show that boxes in sparse vegetation were more successful than those in dense vegetation (logistic regression: B = 0.20, Z = 2.44; $P < 0.001$) and boxes in sparse vegetation were preferred (logistic regression: B = 0.05, Z = 2.66; $P < 0.01$). This suggests that within a given habitat, female House Wrens prefer cavities in sparse vegetation, presumably because fewer nests are lost to predators. Because male House Wrens exhibit strong territory tenacity (Kendeigh 1941) and, at PPP, defended most boxes that we distributed at regular distances along two transects, we cannot use data from this site to examine male preferences.

EXPERIMENTAL TEST OF NEST SITE PREFERENCES

We tested House Wren nesting site preferences at MBB by offering wrens 20 groups of three boxes placed in vegetation of different densities. Nest boxes differed only in density of surrounding vegetation (Fig. 1; one-way ANOVA. $F_{2,57} = 23.0$; $P < 0.01$). Nineteen of 20

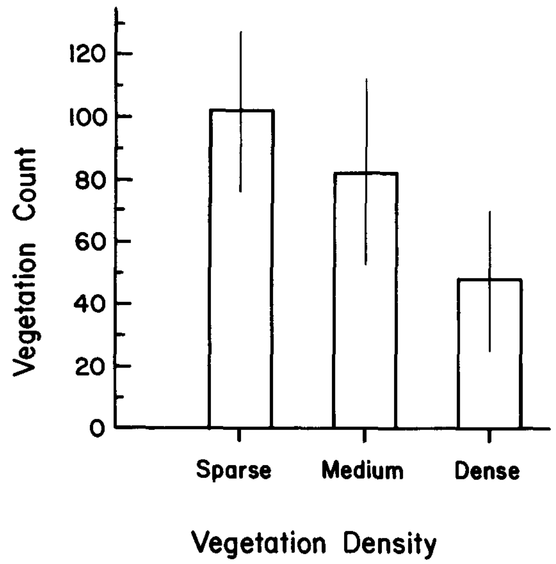

FIGURE 1. Mean vegetation count (±SD) for boxes placed in sparse, medium, and dense vegetation. For each group $n = 20$.

groups of boxes attracted male House Wrens. No males have included two groups of boxes within their territories. The only group that failed to attract a male had all three boxes in relatively dense vegetation (at each of these boxes the vegetation index was below the mean vegetation count for dense vegetation). A total of four groups of boxes failed to attract a female. Most of these boxes, however, were advertised late in the season when no new clutches were laid. Nine groups of boxes were emptied after the first brood fledged and nests were reestablished in five of these.

Both male and female wrens at MBB preferred boxes in sparse vegetation (Table 1). Two of the four boxes in medium vegetation selected by a male or a female had sparser vegetation than the average density for sparse sites. Neither sex selected boxes in dense vegetation.

DISCUSSION

The results of this study suggest that male and female House Wrens prefer to nest in sparse vegetation. In contrast, Bent (1948) stated that House Wrens prefer cryptic nesting cavities. Occupation, however, does not necessarily indicate preference (Nilsson 1984). Suitable nesting cavities are probably scarce in natural settings (e.g., von Hartman 1957, Hilden 1965, Pinkowski 1977), and intense competition might force some birds to select lower quality nesting sites. Bent (1948) did not offer House Wrens a choice between nest sites of different quality. Our data therefore provide a better indication of House Wren nest site preference.

Kendeigh (1941) also found that nest predation is a major factor reducing House Wren nesting success. By breeding in cavities House Wrens presumably reduce predation by larger animals (Lack 1968, Nice 1957). House Wrens also often destroy nests of other birds, including wrens (Sherman 1925, Kendeigh 1941, Belles-Isles and Picman 1986). Although wrens can successfully defend their nests against conspecifics (Kendeigh 1941, Grove 1981) it should be easier for intruding wrens to approach nest cavities in dense vegetation. Thus, nests in dense vegetation are probably more vulnerable to attacks from conspecifics. Our findings that House Wrens were more successful in sparse vegetation, are consistent with the idea that nest selection in wrens is based on minimizing nest losses to predators, including conspecifics. In addition, boxes in sparse vegetation presumably receive more solar radiation, which may affect nest temperature and thus the amount of incubation required (Kendeigh 1963b). The effect of solar radiation on nest site selection by House Wrens requires further study.

Given that nesting cavities differ substantially in their attractiveness to both sexes, it is possible that a female may occasionally prefer pairing with an already-mated male rather than a bachelor, if, the mated male's territory has a surplus of high quality cavities (Orians 1969). High quality nesting cavities are probably a limiting resource (e.g., von Hartman 1957, Hilden 1965, Pinkowski 1977), and males compete for cavities through territorial behavior (Kendeigh 1941). A male's mating success might therefore be closely tied to his ability to monopolize attractive nest sites. To understand the relative importance of nest site quality in mate choice by female House Wrens, further research should address the following questions: (1) Are cavities occupied by females

TABLE 1. Nest site selection by House Wrens at MBB in relation to vegetation density. The number (%) of nesting boxes used by male and female House Wrens under each density condition is given.

Sex	Vegetation density			Total	χ^2	df	*P*
	Sparse	Medium	Dense				
Male	20 (87)	3 (13)	0 (0)	23	45.5	2	<0.001
Female	17 (81)	4 (19)	0 (0)	21	33.9	2	<0.001

in descending order of quality? and (2) Are males controlling several attractive nest sites more likely to mate polygynously?

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