INADEQUACIES IN THE DESIGN OF PURPLE MARTIN HOUSES

By Charles R. Brown

Purple Martins (*Progne subis*) nest primarily in birdhouses built and erected by humans, and therefore this species, in many parts of its range, has become highly dependent on man to provide it with nesting structures. Evidence now suggests that commercially built martin houses, as well as many homemade ones, are inadequately designed and fall short of meeting the ideal specifications required by martins for successful nesting. In this paper I present data to explain two inadequacies of present martin house design and offer suggestions for improvement.

Wade (1966) describes the rising popularity of Purple Martins as a backyard birdhouse-nesting species in the U.S., and he claims that this rising popularity is, in part, attributable to his company's commercially manufactured aluminum martin houses. Although some of Wade's claims are sales propaganda, it is probably true that his "Trio" birdhouses have increased the public's awareness of the Purple Martin and its dependence on man (and see Kale, 1968). For example, in Sherman, Grayson County, north Texas, the number of Trio birdhouses in the city increased from 3 in 1972 to about 60 in 1978 (Brown, unpubl.).

Because aluminum houses commonly are used as nest structures throughout the eastern U.S. (Jackson and Tate, 1974), it seems appropriate to examine certain design features of these houses. Trio birdhouse apartments measure 6 × 6 × 6 in; entrance holes are 2.125 in in diameter with a prominent "keyhole-shaped" indentation at the base, and the bottom of the entrance hole is 1 in above the floor. Apartment size and entrance hole are the primary features where I quarrel with Wade's design; other aspects of the Trio houses appear adequate and will not be considered here.

Besides embodying the aforementioned specifications in the Trio houses, Wade (1966) urged that homemade martin houses also incorporate the 6 × 6 × 6 in rooms, keyhole entrances, and 1 in distance from floor to entrance. In dealing with people in north Texas who have built martin houses, I found that Wade's specifications are followed frequently, but I do not know if these specifications are followed widely in other parts of the country.

According to Wade (1966: 186–187):

> "Ornithologists and naturalists who have established specifications for a well-designed martin house obtained their data from an authoritative source—the martins themselves. Seeking out natural nesting sites, these scientists made careful measurements, observed closely the home life of the martins and, after years of patient research, decided upon 6×6×6 in. as the best nesting compartment size."

But Wade offers no specific references to those who conducted the "years of patient research;" apparently his chief consultant on martin house design was naturalist T. E. Musselman. Wade suggests also that rooms of martin houses should not exceed 6 × 6 × 6 in because larger rooms add weight to a martin house, and this makes the house harder to raise and lower. (Ease in lowering is an important sales point for Trio houses.) Wade (1966: 187) states:

> "Shaping the entrance hole in the shape of a keyhole—similar to that often found in natural openings in which the bottom of the hole is worn off through use by the birds—provides easier access for the birds, and many modern houses now have this feature."

Wear on heavily used natural cavities may occur to some extent, but this seems to me to be a negligible consideration in designing martin houses.

In contrast, Allen and Nice (1952: 646), 14 years before Wade's publication, noted that many man-made martin house apartments "have rooms too small for the needs of the birds," and they advocated rooms measuring 6 × 7 × 8 in. More recently, Lowery (1974) urged dimensions of 7 × 7 × 7 in and Imhof (1976), 8 × 8 × 6 in. Allen and Nice (1952) did not comment on the distance from the floor to the entrance hole, but Lowery (1974) noted that it should be 2 in and Imhof (1976), 1.5 in.

As part of my continuing studies on the breeding biology and ecology of Purple Martins in Sherman, Texas, I observed the responses of martins to various nest compartment specifications. My observations were confined to 150 pairs of martins that occupied one study colony in Sherman from 1968 to 1977. Of these 150 pairs, 64 (42.7%) nested in three aluminum Trio houses, 67 (44.7%) nested in two wooden houses I built according to Trio design (but minus the keyhole indentation of the entrance), and 19 (12.6%) nested in a wooden house with modified design (see below).

I observed two aspects of martin biology to determine the suitability of nest compartment specifications: (1) size of the nest built by martins in the compartment, and (2) loss of eggs as a result of physical characteristics of the nest compartment.

Nest size.—Widmann (1922) and Allen and Nice (1952) noted that the size of Purple Martin nests may vary greatly, depending on availability of mud and compartment size. My observations suggest further that adult martins build larger nests than yearling birds. The presence of a mud wall also seems to vary (Widmann, 1922; Brown, pers. obs.).

In Sherman, mud walls are always constructed near the front of the nest. The walls may be based on the porch below the entrance and then built upwards and backwards into the entrance. Other mud walls may simply rest on a mat of grass or twigs immediately inside the entrance. A wall of maximum size effectively blocks about one half of the entrance, allowing the birds to enter through an entrance of semicircle shape. In some nests mud is absent but similarly built walls of grass and twigs effectively fill the bottom half of the entrance.

Of the 64 pairs that nested in Trio houses, 30 (46.9%) constructed large mud walls that blocked the keyhole indentation and a portion of the circular entrance. The remaining 34 pairs filled the keyhole and a portion of the circular entrance with twigs and grass. Thus, *all* pairs using Trio houses effectively eliminated the keyhole indentation and a portion of the circular entrance. Of the 67 pairs that nested in the wooden houses that had entrances 1 in above the floor but no keyholes, 20 (29.9%) constructed mud walls, 31 (46.2%) constructed twig-grass walls, and 16 (23.9%) built no appreciable walls. The wooden house with modified design had entrances 2 in above the floor with no keyholes and compartments measuring 7 × 7 × 7 in. Two (10.5%) of the 19 pairs that used this house built mud walls, and the remaining 17 built no appreciable walls. However, all of the pairs that used this modified house constructed a slope of grass and twigs from the entrance downward to the depression where the eggs were laid, and the young when ready to emerge climbed this slope to reach the entrance. The greater percentage of martins that built mud walls in the aluminum houses is significant (Student's t-test; $P < 0.05$).

Loss of eggs.—Widmann (1922) noted that it is not unusual for Purple Martins to brush their eggs out of the nest accidentally. My observations indicate that such accidents occur when martins leave their nests rapidly; their feet lodge underneath the eggs and when they exit, the eggs are "lifted" out of the nest depression and roll out. Or, birds when fighting in the nest may dislodge eggs. Additionally, Purple Martins lose eggs to wandering House Sparrows (*Passer domesticus*) and Starlings (*Sturnus vulgaris*) (Brown, 1977); these losses approach 0.35 eggs per nest (Brown, 1978).

During this study, 16 pairs of Purple Martins lost one or more eggs by brushing them out of the nest. Thirteen (81.2%) of these pairs nested in aluminum houses with mud or grass walls in the entrances. The remaining three pairs nested in the wooden houses that were similar to the Trio design. No losses occurred in the modified wooden house. The difference between losses in aluminum houses and the modified house is significant (Student's t-test; $P < 0.05$).

Losses that were attributed to sparrow and Starling interference consisted of 0.32 per nest in Trio houses, 0.24 per nest in the similarly built wooden houses, and *none* in the modified house. Interestingly, most losses to House Sparrows and Starlings occurred in nests that had twig-grass walls with little or no mud walls. Losses occurred in only two nests that had extensive mud walls. The difference between losses in aluminum houses and the modified house is significant (Student's t-test; $P < 0.05$).

CONCLUSIONS

Jackson and Tate (1974) note that management practices for Purple Martins in the past have been based largely on tradition, and nest site requirements rarely are analyzed objectively. Until now, this statement has been applicable to compartment size and entrance hole specifications.

My findings suggest the following: (1) Keyhole entrances are not needed because all martins effectively fill the keyhole with nesting material. (2) The bottom of the entrance hole should be at least 2 in above the floor. Entrances need to be higher than 1 in above the floor because many martins build walls that effectively increase the depth of the cavity. (When Purple Martins nested in abandoned woodpecker holes, available cavities were likely deeper than Wade's (1966) specifications, because North American picids excavate rather deep cavities (Bent, 1939).) (3) Purple Martins are less likely to brush their eggs out of the nest accidentally if the cavity is deep. (4) House Sparrows and Starlings are less likely to destroy martin eggs in deep cavities or in cavities with a high mud wall. (5) Compartments measuring 6 × 6 × 6 in may be adequate, but cavities of 7 × 7 × 7 in, or larger, probably are more ideally suited to the martin's needs, especially when the cavity is deep and a slope of grass and twigs inside the compartment is needed. Larger compartments also may better deter the young from fledging prematurely (Allen and Nice, 1952). (6) If present commercial martin house design remains unchanged, selection may favor those Purple Martins that consistently build mud walls because fewer egg losses occur from nests with mud walls. (7) Persons building martin houses should construct houses with the optimal design features mentioned herein. Hopefully, commercial construction eventually will incorporate these features.

In this paper I have not considered gourds, which are used commonly in the southeastern states as Purple Martin nest structures (Imhof, 1976; Brown, pers. obs.). Whereas gourds may be inadequate because they have no porches for emerging young as Wade (1966) suggests, this disadvantage may be partly compensated for by their deeper cavities and larger compartment sizes.

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