Nesting Use of Bridges by the Northern Rough-winged Swallow in the Sacramento Area

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The Northern Rough-winged Swallow (*Stelgidopteryx serripennis*) is a widespread breeding species in North and Central America (De Jong 1996). The Breeding Bird Survey shows that the species has declined in California at a relatively high average annual rate of 3.2% since 1966 (Sauer et al. 2007), although it remains relatively common in the Central Valley (Bell et al. 1998, Green 2005), with no recent population decline detected there (Sauer et al. 2007). Its localized occurrence is determined by the availability of suitable nest sites (De Jong 1996). Northern Rough-winged Swallows nest in burrows and crevices located in rocky gorges, banks, road cuts, railroad embankments, gravel pits, eroded streams, and other exposed banks of clay, sand, or gravel. It also uses cavities and crevices in vertical surfaces, including gutters, culverts, drainpipes, and crevices or holes in walls, wharves, and bridges (De Jong 1996).

Use of bridges and other transportation structures by the Northern Rough-winged Swallow has received little attention in scientific literature (Green 2005, De Jong 1996). Our recent observations of the species' use of overpasses and elevated freeways ("bridges") in urban Sacramento suggest that these structures provide nesting opportunities that may allow Northern Rough-winged Swallows to occupy urban areas that otherwise would be unsuitable for them. Better knowledge of the timing of nesting use of bridges may be useful to establish protection measures for maintenance and construction activities on bridges and adjacent lands. Bridges in Sacramento also are known to be occupied by several other hole-nesting species, which raises questions about species interactions and differences in nest site selection within bridges.

We provide initial information on frequency and timing of bridge use and the characteristics of nest sites within bridges used by Northern Rough-winged Swallows in urban Sacramento. We also compare nest site selection by swallows and other bridge nesting species, which may allow coexistence of multiple species at bridge sites.

STUDY AREA

We observed Northern Rough-winged Swallows nesting in bridges of the steel and concrete box girder design (Airola and Grantham 2003) primarily during studies of Purple Martins (*Progne subis*) in Sacramento (Airola and Kopp 2007). Surveyed sites included occupied Purple Martin bridge sites surveyed intensively over the breeding season, other sites suitable for Purple Martin use that were not used by martins (Leeman et al. 2003), and shorter overpasses not considered suitable for Purple Martins. Occupied Purple Martin bridge sites and other suitable martin sites tended to be longer spans (generally >80 m [250 ft]) than the more common overpasses present throughout the area (Airola and Grantham 2003, Leeman et al. 2003). The smaller overpasses were surveyed opportunistically for swallows during general travel around the city. Nest sites within bridges consist of large chambers that are accessed through vertical holes in the undersides of the structures ("weep holes"; Airola and Grantham 2003).

As a result of observed use patterns (see Results), we focused attention on use and characteristics of holes near bridge abutments (i.e., ends of bridge spans; Figure 1). We refer to holes immediately adjacent to abutments as "abutment holes" and holes in the main portion of bridges as "main span holes". Most abutments are diagonally shaped except for a

Figure 1. Sloped abutment at west side of the Arden Way overpass of railroad tracks in Sacramento, California. Note weep-hole entrances to bridge nesting chambers in upper foreground. Weep holes here are 0.8 m (2.3 ft) away from the 1.6 m (5 ft) tall vertical abutment wall. One of these holes adjacent to the abutment wall was used in three different years by Northern Rough-winged Swallows.

short (1-2 m; 3-6 ft) vertical wall at the far upper end ("sloped abutments"), Figure 1). A few of the surveyed sites, generally at shorter overpasses, had "vertical abutments", in which the bridge ends in a full-length vertical wall.

METHODS

We recorded the presence and evidence of breeding use of bridge sites by Northern Rough-winged Swallows during Purple Martin surveys from early February through early August during 2002-2007 (Airola and Grantham 2003, Airola and Kopp 2007). We characterized bridge sites as likely occupied by nesting pairs if we observed swallows during the nesting period. During repeated visits to bridge sites, we mapped holes used by swallows and recorded behaviors that would indicate breeding use (e.g., carrying nest material, removing eggshells, carrying food to young, young seen or heard begging, and dependent fledglings seen outside the nest; see Airola and Grantham 2003). We also used these observations to determine nesting periods and the timing of nesting activities.

We characterized attributes of swallow nest sites from locations where we observed hole use, including entrance-hole heights above the ground and distances to bridge abutments. We compared nest site characteristics of the different species breeding within bridges to determine the possible effects of other species' presence on swallow nest site selection. We compared the proportions of swallow nest sites within abutment holes and main span holes at sites that were both occupied and not occupied by Purple Martins and other cavity nesting species. Comparisons were evaluated statistically using the χ^2 goodness-of-fit test.

RESULTS

We observed a total of 53 pairs of Northern Rough-winged Swallows over the 6 years of the study at 20 different sites. Thirty-six (68%) swallow pairs were at Purple Martin colony sites, and 13 pairs (25%) were at longer bridge sites not occupied by nesting martins. We observed four pairs (7%) opportunistically at shorter overpasses not considered suitable for martins.

The number of swallow nesting pairs at sites occupied by Purple Martins varied from 0 to 2 pairs per year, with an average of 0.5 pairs per martin site. Six survey sites that were not occupied by martins supported 0 to 5 pairs of swallows annually. The greatest number of swallows at a single site (5 pairs in one year) was observed in Interstate 5 above Discovery State Park, a long span not occupied by martins, where swallows used main span holes. Among 43 sites where annual surveys detected nesting swallows (including observations in multiple years at a single site), only 5 (12%) revealed multiple pairs at a site.

Northern Rough-winged Swallows were observed in nesting areas between 11 March and 20 July (N = 123 observations). Swallows were

observed entering weep holes from 31 March through 20 July (N = 62). Nest building was observed between 31 March and 27 April (N = 7), and hatched young were present in nests (based on observations of eggshell removal, adults feeding young, or young heard calling) between 30 April and 7 June (N = 4). Dependent fledglings were observed near nesting areas from 11 to 21 June (N = 3).

Of a total of 40 holes observed used by Northern Rough-winged Swallows (presumably mostly as nest sites), 18 (45%) were within abutment holes located near sloped bridge abutments (Figure 1), 2 (5%) were at vertical abutments, and 20 (50%) were in main span holes. The pattern of swallow use among sites with and without nesting Purple Martins differed substantially. At martin colonies, 18 (60%) of 30 holes used by swallows were located near abutments, while only 2 (20%) of 10 holes in non-martin sites were near abutments. This pattern of hole use at martin and non-martin sites differed significantly ($\chi^2_{1\ d.f.} = 4.80$; $p < 0.05$).

In contrast to the 60% use rate of abutment holes by swallows at martin sites, these holes comprise only 10% of the available holes at sites we studied. Thus, swallows used abutment holes within martin sites substantially more often than would be predicted based on their availability ($\chi^2_{1\ d.f.} = 83.3$, $p < 0.001$). This use pattern suggests that swallows actively seek out abutment holes for nesting use within martin colonies. Our opportunistic data collection methods at non-martin sites does not allow us to rigorously evaluate site selection within these areas, but the use of holes near abutments in only 20% of cases suggests the possibility that when martins are absent, swallows more readily use holes in the main span and are less relegated to abutment holes.

Fourteen rough-winged swallow nest sites measured in abutments at 6 different bridge sites were located an average of 0.7 m (2.0 ft) from the vertical abutment wall with a range of 0.5-0.8 m (1.6-2.6 ft) away from the wall. The height (above ground level) of weep holes used by swallows near sloped abutments averaged 1.4 m (4.3 ft; N=13), and ranged from 1.2-1.6 m (3.6-5.0 ft). Heights above ground within main spans and vertical abutments were not measured individually, but sites were at heights typical of main spans, which were previously characterized as >6 m (18 ft) (Airola and Grantham 2003).

DISCUSSION

Northern Rough-winged Swallows have made widespread use of both longer bridge structures, and perhaps shorter ones, in the Sacramento region. The relative importance of bridges to local rough-winged swallow populations is not known precisely, as the species also is known to make use of river banks, railroad trestles, and other sites within the local area (Airola and Kopp pers. observ.) but the sizes of populations nesting in these habitats have not been quantified.

Examination of nest site characteristics indicates that, at sites we surveyed for Purple Martins, Northern Rough-winged Swallows actively select abutment holes. The swallow's small size and maneuverability (De Jong 1996) apparently allows it to occupy abutment sites, which provide substantially less horizontal and vertical space around the entrance than is present under main span holes.

The frequent use by Northern Rough-winged Swallows of abutment holes at martin colonies, in contrast with the greater use of main span holes in areas where Purple Martins are absent, suggests that interspecific competition may be causing rough-winged swallows to use abutment holes. The competition, however, may not be solely with martins, as most martin colony sites also support nesting White-throated Swifts (*Aeronautus saxatalis*) and European Starlings (*Sturnus vulgaris*) (Airola and Grantham 2003, Leeman et al. 2003). None of these three other species have ever been recorded nesting in abutment holes in Sacramento (Airola and Kopp, unpub. data). The submissiveness of rough-winged swallows in nest site selection in the presence of other species has been widely noted elsewhere (De Jong 1996). The possibility that Northern Rough-winged Swallows are attracted to sites that support other species is not testable from our data. It is possible that the swallows could be simultaneously attracted to sites where other species are nesting (perhaps for the benefit of predator detection) while also being relegated to abutment holes at these sites.

Densities of Northern Rough-winged Swallows in Sacramento nesting areas are lower than reported elsewhere, where groups of pairs often nest in loose colonies (De Jong 1996). The lower density at Sacramento bridges may result from competition with other species or other unknown factors

The Northern Rough-winged Swallow's small size and greater maneuverability, as well as our limited observations from sites not occupied by Purple Martins, suggest that it may be able to occupy a higher proportion of smaller overpasses in the region than the faster-flying Purple Martin and White-throated Swift. Smaller overpasses are more common in the region than longer ones used by the martin and swift (Leeman et al. 2003), suggesting that bridges could be important in supporting the species' regional nesting population.

The Northern Rough-winged Swallow's use of urban bridge sites suggests that it is relatively tolerant of human activities. The widespread use of bridges, however, suggests a need to consider protection during construction and maintenance activities around occupied sites during the nesting season. At present, the available information on swallow responses to construction and maintenance disturbances is inadequate to prescribe detailed protective guidelines, except for identification of periods of occurrence and nesting use (see Results) that may be used to avoid disturbance that could lead to nest failure. Our characterization of the timing of individual nesting behaviors, however, is based on few observations and could be verified through more study, including direct examina-

tion of nest sites with pole-mounted cameras.

Bridge sites may not necessarily be of high conservation importance to the Northern Rough-winged Swallow in the Central Valley, given the species' relative abundance and apparent stability (Bell et al. 1998, Sauer et al. 2007). The species, however, is declining elsewhere in the state (Sauer et al. 2007) for unknown reasons, so it is possible that adoption of bridge sites may be helping to offset other factors, such as loss of vertical banks and other nesting habitats (Garcia et al. 2008). Regardless of their conservation value, use of urban bridges by Northern Rough-winged Swallows provides welcomed opportunities for city dwellers to regularly observe this interesting species.

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Northern Rough-winged Swallow (*Stelgidopteryx serripennis*).

photo by Steve Abbott