

## **Effects of Construction Activities on a Purple Martin Nesting Colony in Sacramento, California**

*Daniel A. Airola, Airola Environmental Consulting, 2700 6th Ave., Sacramento, CA 95818*

*Dan Kopp, 8295 La Riviera Drive, Sacramento, CA 95826*

*Kevin Thomas, 9205 Starina Way, Sacramento, CA 95821*

*Stan Kostka, 28603 Kunde Road, Arlington, WA 98223*

The last remnant of a formerly widespread population of the Purple Martin (*Progne subis*) in California's Central Valley nests solely in elevated freeways and overpasses ('bridges') in the Sacramento region (i.e. the City of Sacramento, Sacramento County and one recent nest site western Placer County; Airola and Grantham 2003, Airola and Williams 2008, Kopp and Airola 2007). These urbanized nesting locations expose the species to human disturbances resulting from construction and maintenance activities, and from changes in surrounding land uses (Airola et al. 2008). Therefore, information on responses to disturbance and land uses is important for this species' protection and recovery.

Purple Martins tolerate substantial amounts of human activity (Brown 1997, Airola and Grantham 2003), but their specific tolerance limits are not well known. Martins in Sacramento avoid areas with high traffic volumes (Leeman et al. 2003), and breeding pairs at one colony ("35th St.") declined by 90% during a period when traffic volume increased substantially (Airola et al. 2004, 2008). Conversely, Sacramento Purple Martins have tolerated a variety of land uses beneath and adjacent to their colonies including light rail line construction, storing construction material and vehicles, bridge repair, vegetation control, and camping by homeless people (Airola and Grantham 2003, Airola and Kopp 2005). Therefore, applying measures that are often used to exclude other bridge-nesting swallows from nesting sites to reduce disturbance during construction has been suggested as unnecessary and harmful to Purple Martins, by reducing reproductive success or disrupting breeding site fidelity (Airola and Grantham 2003, Airola et al. 2008). No detailed studies, however, have evaluated effects of construction activities on bridge-nesting Purple Martin populations. This uncertainty has created concern about whether and how to manage disturbance to protect the species.

In 2008, Catholic Health West, Inc. (CHW) initiated construction of a parking lot on land leased from California Department of Transportation (Caltrans) beneath the Capital City Freeway in Sacramento. The site has supported a Purple Martin nesting colony since at least 2002 (Airola et al.

2008). Project construction involved excavating, grading, paving, and installing curbs, drainage, lighting, fencing, and landscaping.

We had previously monitored this colony location, as well as all other known colonies in the Sacramento region, since 2002 (Airola et al. 2008). Therefore, we had well-documented information on the size of the nesting populations at this and other colonies, to evaluate whether populations changes may have occurred in response to construction. We also have acquired a thorough knowledge of the timing of nesting activities through monitoring of nesting activities, including with pole-mounted video cameras. Martins in Sacramento arrive at breeding colonies over an extended period between mid-March and mid May. Nest building generally occurs during late April through early June, followed by egg laying and incubation (late May - late June), nestling attendance (early June - mid July), and fledging and a subsequent roosting use of nest sites by family groups (late June - early August) (Airola, Kopp and Thomas, unpub. data).

In early contacts, we encouraged Caltrans and CHW to construct during the non-nesting season or late in the nesting season to reduce disturbance effects on nesting martins. They determined that this schedule was infeasible and scheduled construction during the height of the nesting season. We also offered suggestions for landscaping and project design to minimize potential long-term habitat effects. The project environmental document required monitoring of Purple Martin use of the site during construction (Caltrans 2007). We performed this monitoring for CHW's construction contractor.

Project monitoring offered an opportunity to evaluate Purple Martin responses to major construction activities directly beneath a bridge-nesting colony. Objectives were to determine:

- behavioral responses of martins to construction activities,
- effects of construction on martin nest site occupancy and reproduction,
- potential effects of landscaping changes on habitat suitability for martins, and
- recommendations for future construction projects.

Based on the expected intensity and timing of construction activities, we predicted that parking lot construction would displace nesting birds, result in a decrease in the nesting population, and reduce reproductive success.

## STUDY AREA

The parking lot site is within the Caltrans-owned right-of way located beneath the Capital City Freeway (i.e., "Business 80") in the area bounded by Q, S, 29th and 30th Streets in Sacramento. Prior to construction, the northern portion of the site (north of the R St. light rail station; "north lot") was occupied by a mini-storage facility, while the southern portion ("south

lot”) was an open graveled and fenced area used infrequently to park construction equipment until fall 2007. The south lot supports a Purple Martin nest colony (“S St. colony”, see Leeman et al. 2003).

We have monitored Purple Martins at the S St. colony annually since 2002 to determine number of nesting pairs of martins and conducted reproductive surveys in 2007 (Airola et al. 2008), thereby providing a basis for evaluating construction effects during the 2008 construction season. We also have monitored populations at nearly all other Sacramento colonies since 2002 (Airola et al. 2008, in press), which provided “control” areas where construction did not occur, to allow comparison to the S St. colony site.

## METHODS

Prior to construction, D. Airola provided landscape design suggestions for coordinating City of Sacramento shade tree planting requirements with the long-term needs for Purple Martin nest site access. He also recommended retaining utility wires used as perch sites by martins, which were proposed for relocation underground. We evaluated the post-project suitability of habitat conditions for martins within the north and south lots by comparing them with pre-project conditions, including airspace available for flight access, suitability of perches, availability of areas to collect nesting material, and levels of human disturbance. We evaluated conditions based on past use of site features by martins.

We regularly observed construction activities during visits to the parking lot every 1-3 days during the construction period. We recorded the work type and location, and numbers of workers and pieces of equipment onsite.

We conducted visual surveys of the Purple Martin population to record behaviors and nesting activities, and to read color band codes on previously banded martins. These observations took place on portions of 36 days between 29 March and 16 July 2008. We evaluated martin responses to construction activities (i.e., flushing, alarm calling) during site visits. We monitored colony site fidelity of banded martins through repeated searches for banded birds at S St. and other Sacramento colony sites.

We also evaluated population parameters, including nest site locations, nesting population size, and reproduction. We determined nest site locations by mapping hole entries by birds and recording diagnostic breeding behaviors (i.e., birds carrying food to the nest, birds removing fecal sacs, our hearing or observing begging nestlings; Airola and Grantham 2003). We compared nest site locations with sites used in previous years to determine if Purple Martins changed nest locations. We compared the size of the 2008 nesting population to previous year’s populations at the site to determine if changes occurred. We determined reproductive success by inspecting holes with a pole-mounted video camera on five visits between

8 June and 12 July, the period from late incubation until nestlings fledged (see Airola et al. 2008).

We compared the nesting population size and reproduction at the S St. colony in 2008 to those from previous years at S St., and to those from other Sacramento Purple Martin colonies in 2008, to indicate if changes at S St. may have been a result of localized effects (e.g., construction disturbance) or a regional phenomenon.

## RESULTS

### *Changes to Construction Design*

Following our discussions with the City of Sacramento's arborist and the CHW's representatives, the landscaping plan was modified to eliminate planting of tall-growing tree in the area that serves as the main flight path between Purple Martin nesting and foraging areas (i.e., between the western edge of the Capital City Freeway and 29th St.). The City and CHW's contractors also agreed not to relocate underground the utility lines used as perch sites by Purple Martins.

### *Construction Activities*

The south lot was used for temporary parking from the onset of monitoring in early March through early April. Onsite construction began on 9 April, and up to 10 pieces of equipment and at least 10 workers were onsite nearly daily through mid-May conducting excavating, grading, compacting, trenching, and dust abatement. The areas immediately below past and current nest sites were within the main construction area. Paving began 15 May, and by 23 May most major construction was complete and the site was again used for vehicle parking. Landscaping, fencing, and lighting pole installation continued through mid-July. Overall, construction occurred during the entire Purple Martin nesting season, with the highest intensity work conducted at the beginning of the nesting period, when martins were selecting mates and nest sites.

### *Responses to Construction*

The Purple Martins' behavior clearly indicated that they were alarmed by construction activity. They regularly flushed from their favored perch wire along 29th St. when equipment and workers approached. Equipment and human activity beneath or adjacent to nest sites elicited alarm calls ("zweet" call, Brown 1997). Construction activity also disrupted delivery of nesting material and of food to nestlings, as we regularly observed martins interrupt their prey delivery flights and wait at the perch wire when construction was occurring below nest sites, which is an atypical behavior.

Although such disturbances often occurred many times per day, the birds also had substantial periods of time when no disturbance occurred and normal activities resumed.

We observed four color-banded Purple Martins at S St. early in the nesting season (all first observed between 13 and 19 April). Three of these birds remained through the main construction period (last seen on 8, 25, and 28 June), including one that was recaptured during banding on 25 June at a successful nest site. One banded bird was last seen at the S St. colony on 3 May during the height of construction. We also did not observe it subsequently in 2008 during intensive efforts to read bands at other colony sites (i.e., during which we made an average of 12 “band-checks” per breeding bird at other colonies) nor during intensive surveys through April 2009. Our inability to locate this bird, despite these intensive searches suggests that it was not displaced during construction, but rather died. We observed one male Purple Martin within a nest cavity on 8 June that had died of undetermined causes. The nest was subsequently attended by both a male and female, and produced 2 young that were last verified in the nest on 28 June at 25 days old, just a few days before typical fledging age.

### *Nesting Population Sizes and Locations*

Seven pairs of Purple Martins nested at the S St. site in 2008, a decline of two pairs (22%) from the 2007 nesting population of nine pairs at this site (Airola et al. 2008). (The 2007 count used here does not include a pair that nested two blocks away at 29th and T St. during 2007, which was included in the 2007 site totals for this colony.) This level of decline is identical to the 22% reduction that occurred at other Sacramento Purple Martin colonies in 2008 (Airola et al. in press). Five of the seven weep holes used in 2008 also had been used in 2007, and the two others were immediately adjacent to previously used holes, indicating that martins were not displaced from previously used nest sites.

### *Reproductive Success*

Reproductive monitoring and observations of nest site use confirmed that all seven Purple Martin nesting attempts were successful in 2008. Fledgling production varied from two to five young per pair and averaged 3.2 young per nesting pair for six nests where reproduction could be determined adequately. This reproductive rate is similar to or greater than the average calculated from three other colony sites (2.1 young per nesting pair;  $N = 17$ ) in 2008, although this difference was not statistically significant ( $\chi^2_{4d.f.} = 2.7, p > 0.50$ ). Reproduction at S St. in 2008 also was similar to that of Purple Martins nesting at the site in 2007 (2.9 young per pair; Airola, unpub. data) and the population as a whole in 2007 (3.4 young per nesting pair; Airola et al. 2008).

The new parking lot changed the habitat conditions for Purple Martins at the site. Potential positive habitat changes for the existing colony site included removal of trees that may have impeded martin flight access to nest sites and restricting new tree plantings to smaller forms within martin flight routes. Removing the mini-storage facility on the north lot also increased flight accessibility to this previously unused potential nesting area.

Potential negative habitat changes included the installation of light poles that may provide perches and encourage use of weep holes by European Starlings (*Sturnus vulgaris*) (Airola unpub. data). Also, the placement of a new bus station may obstruct Purple Martin access to nest sites overhead that martins have regularly used since at least 2002. Several changes are not considered likely to have detrimental effects on martins, including increased human use of the site for parking and reduced availability and access to onsite nesting material (because martins have previously used traditional offsite areas to gather nesting material in addition to onsite ones).

## DISCUSSION

Incorporation of proposed changes to landscaping and utility plans avoided immediate loss of important Purple Martin perching habitat and potential long-term detrimental effects of landscaping on flight access by martins. Notably, these issues were not addressed in the project environmental document (Caltrans 2007), but were addressed only because we raised them subsequently. This treatment reinforces our previous recommendations that a comprehensive plan is needed to address site management, impact evaluation, and mitigation for Sacramento martin bridge colonies (Airola et al. 2008).

Monitoring showed that high intensity construction activity occurred during the early portion of the Purple Martin nesting season, which is the time when birds are generally considered to be most sensitive to disturbance (e.g., Westmoreland and Best 1985, Verboven et al. 2001). Although construction activity regularly disturbed martins, contrary to our predictions it did not displace birds from the colony or alter nest site locations within the colony. Although the nesting population declined, the fact that the extent of the decline was identical to other nearby colonies suggests a regional cause (i.e., increased vehicle traffic and associated mortality, weather, food supply; Airola et al. 2008, and in press) rather than a local one. Reproduction at S St. in 2008 was similar to or greater than that at other colonies in 2008 and with previous years at this site, as well as within the range of values reported for the species as a whole (Brown 1997). Therefore, the results do not support a conclusion that the high level of construction activity resulted in a detrimental effect on the martin population at the site

during 2008. Rather, the martins appeared to have tolerated the disturbance.

Prior to 2008, we considered the S St. colony as one where Purple Martins were most alarmed by any human activity. Martins showed a high degree of alarm calling and mobbing (Brown 1997) during our access to capture and band birds or document nestling fallout, presumably because no human activity occurred there. The 2008 observations indicate that martins appear to adapt relatively quickly to increases in human activity from no human use to vehicle parking use and then to construction.

The high tolerance by the S St. Purple Martins of construction activity has implications for other construction projects. Often, project mitigation measures have proposed excluding martins from bridges where construction is scheduled (Airola and Grantham 2003, Airola et al. 2008), as is typically done for other more common swallows and other bridge-nesting birds. Exclusion of martins from a traditionally used site has potential to disrupt that year's reproduction, which may be a serious impact for this small and declining population. The lack of reproductive disruption observed during this project, suggests that Caltrans and other agencies should not apply Purple Martin exclusion as a construction mitigation measure, except when the interior of nesting chambers will be directly modified during the nesting season.

This study has not addressed the effects of construction on Purple Martin use of the site for nesting in subsequent years. Past monitoring, however, has shown that a high proportion of the martins that nest successfully at a colony and survive to breed in a subsequent year return to breed at the same colony (Airola, unpub. data). Therefore, considering the high rate of nesting success observed during 2008, it is likely that construction disturbance will not result in any subsequent detrimental effect. The effects of habitat changes as a result of construction, however, are less certain and warrant continued monitoring.

## ACKNOWLEDGEMENTS

We thank Dave Padgham (Separovich-Domich) and Lee Ann Lambrith (Caltrans) for facilitating this study and Catholic Health West for funding and cooperation. Sacramento Audubon Society also partially funded monitoring at this and other colonies in 2008. Construction contractor Ken Ewert (West Fork Construction) cooperated graciously during onsite monitoring. Arborist Duane Goosen (City of Sacramento) provided guidance on landscaping recommendations and graciously accepted our suggestions. Lynn Schmidt, Dawn Garcia, Mike Fisher, Maureen Geiger, and Karlien and Jordan Lang assisted in capturing and banding martins at this site.

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Purple Martin

*sketch by Tim Manolis*