Another Substantial Decline in the Sacramento Purple Martin Nesting Population in 2018: The Role of Construction Disturbance and Future Threats

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The breeding population of the western Purple Martin (*Progne subis arboricola*) in the Sacramento area is the last sizable remnant of a much large Central Valley, California, breeding population. The Purple Martin was recognized as a Species of Special Concern by the California Department of Fish and Wildlife due to declines in the extent of its geographic range and numbers (Airola and Williams 2008). Since then, little monitoring has occurred except in a few areas, but declines are documented in several long-occupied areas of the state (Airola 2009, Airola et al. 2014). We have monitored this population annually since 2002 and documented declines by 80% from 2004 to 2017 (Airola and Kopp 2017).

We report results of our monitoring during the 2018 breeding season. We also report on conservation challenges identified in 2018, including reinvigorated plans to remove nesting habitat and active disturbance by construction projects that may have resulted in reduction in the nesting population at one of the largest colonies and caused direct failure of all nesting pairs that used the colony site.

STUDY AREA

We surveyed for and compiled records of nesting Purple Martins at longer overpasses and elevated freeways ("bridges") in the Sacramento region, California (including the City of Sacramento and parts of Sacramento and Placer counties) that were previously occupied or identified as suitable for nesting by the species (Leeman et al. 2003, Airola and Kopp 2017).

METHODS

In 2018, we surveyed 13 of 15 sites where martins have nested since 2002 and all sites occupied since 2013 (Table 1) as well as four additional suitable sites that have not been previously occupied. We checked eBird (https://ebird.org) for other records during the 2018 nesting season. We assessed reliability of eBird reports of nesting based on the number of reports, timing, location, and reported observations.

We monitored colonies using the standard methods used since 2002 (Airola and Grantham 2003). We made multiple visits to former and potential nest colony sites to determine occupation.

We mapped use of "weep holes" in the undersides of bridges and recorded diagnostic breeding behaviors (i.e., carrying food to nests, removing fecal sacs, begging by nestlings, and nestlings perched at hole entrances) to identify occupied nest holes and thus number of nesting pairs. We conducted at least 10 visits per colony during 15 April to 15 July. We also documented responses of birds to construction disturbance at one colony, where Kopp made 54 visits over the season.

We documented attempted contacts with Planning and Public Works Department staff at the City of Sacramento to address immediate construction impacts and long-term project risks at colony sites.

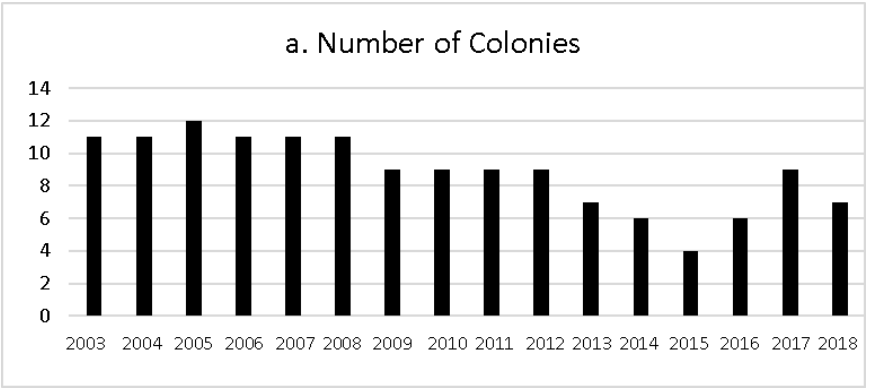
RESULTS AND DISCUSSION

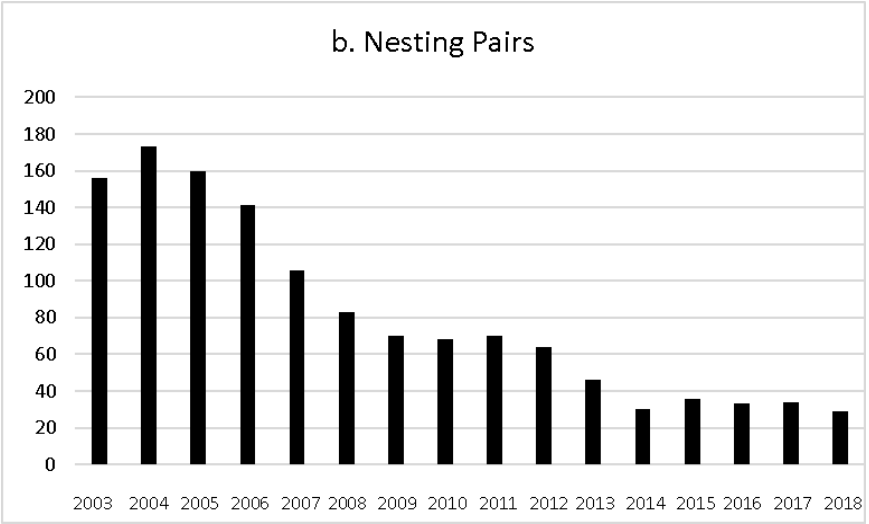
Nesting Population Status and Colony Occupancy

A total of 29 Purple Martin pairs nested at Sacramento area colonies in 2018, all of which were confirmed by diagnostic breeding behaviors except one pair that likely failed during the incubation or early nestling stage and one pair reported in eBird. The number of nesting pairs decreased by five pairs (15%) from 2017 (Table 1, Figure 1).

As of 2018, the Sacramento martin nesting population has declined by 83% from its high of 173 pairs in 2004 (Figure 1). Numbers of nesting pairs at colonies decreased substantially from 2017 at S St (by three pairs; 50%) and Redding Ave. (by three pairs, 43%) and by a single pair (11%) at Roseville Rd (Table 1). The three sites that supported single pairs in 2017 (Arden, El Camino, and Marconi) did not support nesting martins in 2018. Numbers of pairs increased by a single pair at I St, Sutterville, and 35th St., in addition to recolonization of the Hwy 65/Taylor site by a single pair. The changes in numbers of pairs at 2018 colony sites were not associated with observable changes in habitat conditions, except for construction disturbance at Redding Ave (See *Martin Displacement and Nesting Failure in Construction Area*).

Purple Martins nested at seven colony sites in Sacramento during 2018 (Table 1), which represents a decrease by two colonies from 2017. One site, Hwy 65/Taylor in Placer County, was reoccupied after not having been known to support nesting martins since 2012 and before that in 2008. Three sites that were abandoned had hosted only a single pair in 2017. Over our 17-year study, sites that supported single pairs were abandoned in 50% of the subsequent years (7 of 14 times; Table 1). The colonization of four sites by single pairs occurred in 2017 when the total breeding population increased modestly (Airola and Kopp 2017). Abandonment of three of those four sites in 2018 coincided with a substantial population decrease.





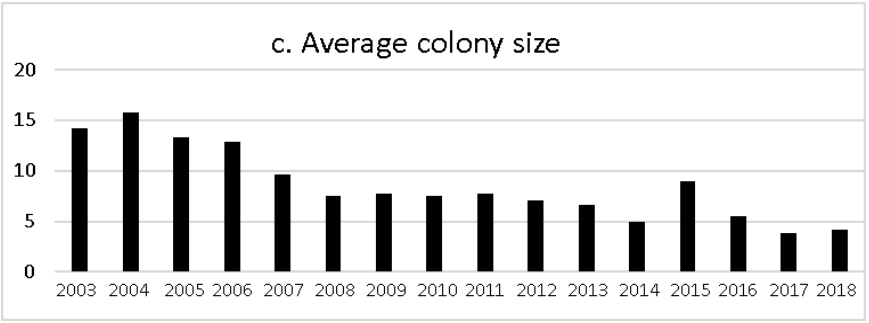


Figure 1. Changes in the number of Purple Martin nesting colonies, nesting pairs, and average number of nesting pairs per colony in Sacramento 2003 -2018.

Table 1. Number of breeding pairs of Purple Martins at colonies in the Sacramento region, California, 2002-2018

Colony	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
I Street	37	29	35	32	17	11	6	5	4	5	7	5	7	11	7	4	5
20th Street	14	21	23	23	16	15	6	5	1	3	2						
Sutterville	4	6	8	5	6	6	5	6	8	10	10	10	1			1	2
Broadway	8	7	7	7	5	1	1										
S Street	14	14	16	14	18	9	7	6	7	7	7	3	4	6	5	6	4
35th Street	29	19	15	14	6	3	3	1	2	3	1	2	1		1	4	5
Redding Rd.	0	3	12	10	14	14	15	17	16	20	20	13	10	9	12	7	4
Arden	ns[a]		3	6	13	9	11	12	9	3						1	
El Camino	ns	15	23	21	21	20	11	5	10	7	7	3			1	1	
Marconi	ns	1	4	3												1	
Roseville Rd.	29	39	27	24	24	17	17	13	11	12	9	10	7	10	7	9	8
Airbase	ns			1	1												
Hwy 65/Taylor	ns	ns	ns	ns	ns	1	1				1						1
Pole Line	ns	2															
Total	135	156	173	160	141	106	83	70	68	70	64	46	30	36	33	34	29

[a]ns = not surveyed; blanks = surveyed and no pairs were present

We did not survey the Hwy65/Taylor site in 2018, but considered it as occupied, based on three separate eBird reports from 3-5 July. Two observers described an ASY male martin. Two observers also reported birds carrying nesting material, which would be highly unusual because martins at Sacramento area colonies construct nests during May and the first week in June. We believe it more likely that observers saw martins carrying food to nestlings at this time.

Average size of the colonies in 2018 (4.1 pairs/colony) increased slightly from the all-time low of 3.8 in 2017 Figure 1), but this increase simply resulted from the net loss of the two single pair colonies between the two years. For the second straight year, no colony exceeded eight pairs.

Four (14%) of 29 nesting pairs in 2018 included SY males. This proportion is slightly lower than the 18% in 2017, when SY-pairs contributed to the modest increase in the nesting population that year, but higher than observed in the previous four years (i.e., 6% in 2013 and 2016 and 0% in 2014 and 2015).

Martin Displacement and Nesting Failure in Construction Area

The Redding Ave. colony was substantially disturbed by construction activity in 2018 that may have displaced martins from the area and caused nesting failure for those pairs that attempted to nest. This colony has supported the highest average number of nesting pairs (10) over the past five years, but the nesting population there declined to four pairs in 2018, all of which failed while nestlings were in the nest. We first review the inconsistent environmental requirements for Purple Martin protection under the construction project and then describe observed effects.

Purple Martin Treatment in Environmental Documents. Construction at Redding Ave. was conducted as part of the California Department of Transportation's (Caltrans) and City of Sacramento's Folsom Boulevard Widening/Ramona Avenue Extension Project ("Folsom-Ramona project"; Caltrans and City of Sacramento 2011). The Folsom-Ramona project was a specific project conducted within the 65th Street Station Planning area that addressed roadway improvements beneath and adjacent to the elevated section of US Highway 50 (US 50) that supports the Redding Ave. colony.

The 65th Street Station Area Plan Draft EIR (City of Sacramento 2009) identified that Purple Martins nested within US 50 within the project area. It specified that if construction were to occur within 500 ft (150 m) of nest sites during 1 February to 1 August, a qualified biologist would be required to conduct surveys and submit a report to the City and the California Department of Fish and Wildlife (CDFW). It also specified that if active nests were identified, construction would be delayed during the nesting season

while nests are occupied. If construction could not be delayed, a minimum 200-ft construction buffer would be established, and a biological monitor would determine if construction activities disturbed birds.

A separate EIR was prepared for the Folsom-Ramona project (Caltrans and City of Sacramento 2011). For unknown reasons, it did not reference the 65th Street Station Area Plan Draft EIR. The presence of Purple Martins was not noted, and no mitigation measures were identified. A comment letter submitted on the Draft EIR noted the presence of Purple Martins at the site, but Caltrans' and the City's response in the project's Final EIR was to generally characterize the Purple Martin as one of a number of common species, despite its status then as a state Species of Special Concern, and to not offer any additional mitigation (Caltrans and City of Sacramento 2012).

We had reviewed the 65th St. Station EIR and believed that the mitigation measures therein were adequate to protect Purple Martins. We learned of the Folsom-Ramona project EIR in 2017, after it had been finalized, but were unaware of when construction would occur until April 2018, when Kopp observed construction activities during monitoring of active nests at the colony.

Construction Activity and Effects. Project construction at the Redding Ave. site was overseen by the City of Sacramento and implemented by a construction contractor, except for work conducted by Union Pacific Railroad.

Kopp first observed construction activity at the site during March. On 19 March, he first contacted the responsible City Planner to notify the City of potential conflicts between construction and Purple Martin nesting. On 21 March, the planner identified a Public Works Division employee as the Construction Project Manager and copied him on his message. Kopp received no reply to this message, nor to subsequent messages he sent to the designated Construction Project Manager on 4, 12, 22, 23, and 25 June or from members of the Planning Division that he copied on the messages. On 27 June, the designated Construction Project Manager provided his first response to Kopp, notifying him that management responsibility for the project had been shifted to a different individual.

During mid-May to early July, Kopp observed construction activities (early abutment work) 10-20 m (30-60 ft) from two nest sites. On 22 June, UP began digging trenches and boring to install 12 3-inch (7.7 cm) conduits in an area below and adjacent to two nests (Figure 2). The operation involved loud machinery and the presence of up to eight workers, which caused the martins to issue alarm calls and circle, deferring food delivery to nestlings as well as alerting American Kestrels to the likelihood of nesting young.

Figure 2. Conduit installation site beneath Purple Martin nest sites at the Redding Ave. colony, Sacramento, 2018.

Over 19-24 June, Kopp repeatedly observed major construction activity beneath the colony. Martins gave loud alarm calls and delayed feeding young, which were about 20 days old at the time. At 19:25 on 25 June, an adult American Kestrel (*Falco sparverius*), which was nesting in an adjacent industrial building as in past years (Airola and Kopp 2018) flew directly to one of the martin nest entry holes (hole "I5" in our survey system) and entered the nest chamber. After an adult male martin entered the hole with a dragonfly for nestlings, the kestrel exited the hole carrying an adult female Purple Martin, which it delivered to a nearby fledgling kestrel (Figure 3). Visits on 11 subsequent days showed that adults returned to two holes that no longer contained young (based on lack of begging calls), indicating that kestrels likely had removed the nestlings from these holes.

Figure 3. Fledgling American Kestrel with adult female Purple Martin taken by adult kestrel from an active nest site at the Redding Ave. colony site, Sacramento, California, 25 June 2018.

On 27 June, we made our first contact with a newly assigned City Construction Project Manager. He readily agreed to direct the city's contractors to avoid working under the nesting colony to protect the two remaining active nests. The City said they were hiring a biologist to monitor the site. Airola also talked with a UP site supervisor at the site on the morning of 28 June and informed him of the disturbance issue and requested that

work beneath the colony be delayed for 1-2 weeks until young had fledged. The supervisor replied that UP had no obligation to protect the birds and no intention of delaying construction, but UP would be unable to proceed with the work if the City stopped their work. The City's Construction Project Manager later informed us that the portion of the work being done by UP was not under his control.

No biological monitor was observed by us during periodic daily visits, and despite the previous communication, UP continued to construct beneath the colony, which continued to support two active nests. On 1 and 3 July, UP worked directly beneath one of the nest holes, installing new railroad ties and a small building (Figure 4), which alarmed the martins substantially.

On 4 July, Kopp found the two remaining nest holes to be abandoned (i.e., no feeding was occurring). Kopp monitored the site in the evening to determine if adults returned to roost in nest holes with young, as is a typical for several weeks after fledging (Kopp and Airola 2012). He observed seven adults, presumably from the four pairs that had nested there, return without young on 4 July and on subsequent nights. The lack of observation of young being fed in holes or returning to roost is strong evidence that all four nests failed before fledging young.

In summary, active construction by the City contractors and UP on the Folsom-Ramona project may have displaced some nesting pairs from the Redding Ave colony site and caused or contributed to nesting failure of all four of the pairs that nested at the site while they had young in the nests.

Threat of the I St. Bridge Project Re-emerges

In September 2017, the City of Sacramento and Caltrans released the Draft EIR on the I St. Bridge replacement project (City of Sacramento and Caltrans 2017). This project would remove motor vehicle traffic (except trains) from the I St Bridge across the Sacramento River between the cities of Sacramento and West Sacramento. It also would remove elevated features on the east (Sacramento) side of the bridge, including a northern viaduct, the I St. Bridge approach, and the offramp connection to J St. The J St. offramp is of box-girder construction and has housed a Purple Martin colony since the early 1970s (Airola and Grantham 2003). The site has consistently supported the second largest number of Purple Martins of any colony site, notwithstanding the decline in numbers from >30 pairs in the early 2000s to 4-11 pairs during 2010-2017 (Table 1).

Figure 4. Union Pacific equipment staged at construction site below active Purple Martin nests at the Redding Ave. colony, 27 June 2018.

In 2015, during the early scoping stage of the environmental analysis for the Project, we raised the issue of potential effects on the I St. Purple Martin colony. In 2016, the responsible Supervising Engineer met with Airola at the project site. At that time, he expressed receptivity to considering a project alternative that would maintain the J St. offramp (Airola and Kopp 2017). The Draft EIR released in late 2017, however, did not including any alternative or mitigation measure that would protect the colony site. Other than direct avoidance of construction impacts during the nesting season, the only substantive mitigation measure included was incorporation of the box-girder design for the new bridge, which would provide weep holes for entry to the bridge by Purple Martins. The portion of the bridge where weep holes would be available, however, were directly over the Sacramento River. Similar sites on the American River (e.g., Howe, Watt, Sunrise, and Hazel Avenues) have never been occupied by Purple Martins, presumably due to windy over-river conditions that prevent martins from accessing holes to feed young.

Comment letters on the Draft EIR supporting protection of martin nesting habitat were submitted jointly by the Central Valley Bird Club (CVBC) and California Audubon, and individually by Sacramento Audubon and the

Western Purple Martin Working Group. They requested a meeting with the City and Caltrans. Caltrans was nonresponsive. On 13 March 2018 representatives of conservation commenters met with the responsible City Engineer and Planners. The groups again requested maintenance of the bridge offramp as a martin nesting site and as a pedestrian and bicycle access to downtown Sacramento. City staff did not commit to any consideration of retaining the colony site. The major reason cited was that the costs for demolition could be funded by a federal grant but retaining the structure would require the City alone to bear substantial annual maintenance costs. The group asked for documentation of the costs of demolition and maintenance, and received a single cost for each option, but repeated request for more detailed documentation of costs have not been responded to by City staff (as of August 2018). In October 2018, Sacramento Audubon requested a meeting with the Mayor of Sacramento to discuss the martin issue and seek resolution.

Causes for Population Decline

The Sacramento Purple Martin population has been declining continuously at all colony sites since 2004 (Table 1). The overriding cause of this long-term decline, determined mostly through a process of elimination of potential factors, appears to be a reduction in food supply resulting from the rapid and substantial increase in the use of neonicotinoid and/or pyrethroid pesticides over the same period as the martin population has declined (Airola et al. 2014). Changes in climate conditions, including changes in temperature and rainfall and their effects on martin insect prey populations, are also possible but unexplored sources of pervasive population decline across all colonies.

The 15% decline in nesting pairs in 2018 comes after a small (3%) increase in 2017. A possible contributor to the 2018 decline is the displacement of martins from the Redding Ave. site, due to construction disturbance early in the nesting season. The four pairs at this site is substantially less than the 7-13 pairs that nested there over the previous five years. The lack of any substantial increase in numbers at other colonies during 2018 suggests that if pairs were displaced, they did not relocate and breed elsewhere. Perhaps, the displaced birds will relocate to a different colony site next year as we concluded occurred following substantial kestrel disruption at the Sutterville colony in 2013 and 2014 (Airola and Kopp 2013, 2015; Airola et al. 2014). If so, this year's disturbance and displacement may not have led to a population reduction as dramatic as recorded by our counts of nesting pairs, as this measure does not include non-nesting birds.

A more important measure of the population impact of the construction disturbance is that fewer birds may have attempted to breed, and the four pairs that bred at Redding Ave. did not fledge any young. Assuming the loss of

reproduction by 10 pairs at Redding Ave. (i.e., 6 displaced and 4 failed pairs), construction would have reduced successful reproduction by 29% (from 34 to 24 pairs). Such a loss, for a breeding population that has already been declining, will likely contribute to a larger decline over the next few years.

We previously studied the effects of construction beneath a colony of nesting martins and concluded that the effects were minimal (Airola, et al. 2009). In that case, however, most of the martins were concentrated in a small portion of the project site, and as a result the disturbance was intermittent beneath the nest sites, and adults were able to regularly feed young despite periodic disturbance. Also, American Kestrels were not present at this site. Although we did not monitor the Redding Ave. site continuously in 2018, construction activity appears to have been more concentrated and continuous there. The 2018 results there demonstrate the difficulty of predicting martin responses to construction activity at their nest sites.

Future Prospects for the Purple Martin in Sacramento

As documented here, the future is precarious for the Purple Martin in Sacramento. The apparent effect of prey decline due to widespread pesticide use appears to be continuing to diminish the population. The primary conservation strategy for the species in Sacramento is to maintain a breeding population until pesticides are more stringently regulated or eliminated, as the European Union did in April 2018.

The major current threat to the Purple Martin in Sacramento is the actions of the City of Sacramento's Community Planning and Public Works Divisions. With the exception of appropriate treatment in the Downtown Railyard project, the City has repeatedly ignored measures recommended to protect Purple Martin colonies in and near proposed city projects, as exemplified by the Folsom-Ramona and I St. Bridge projects.

Changes in the modes of operation of these City of Sacramento Divisions are imperative for the conservation of the Purple Martin in Sacramento. Disturbance during construction at the Redding Ave. colony may qualify as a violation of the California Fish and Game Code (Sections 3503 and 3513). We recommend that CDFW work with the City to enact measures that may help to ensure that future projects do not intentionally or unintentionally harm martin nesting habitat and nesting birds. These measures may include protection of the I St. Bridge colony site, training of responsible personnel regarding martin habitat needs and legal protections; preparation of colony site management plans to guide future planning; sponsorship of future monitoring of martin breeding populations, reproduction, and survival; installation of "nest guards" (Airola and Grantham 2003) to reduce incidence of nestling fall-out from nest holes, and developing and implementing a plan to discourage or control American Kestrel nesting at the two sites where they

occur. We have suggested these measures to CDFW, but no action has yet been taken.

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