

Sacramento Purple Martin Nesting Population: Decline Continues and New Predation Threat Emerges in 2013

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We report on the status of the 2013 nesting population of the Purple Martin (*Progne subis*) in the Sacramento area. This area has supported the last sizable nesting population in California's Central Valley, where it was once widespread (Airola and Williams 2008). The Purple Martin is recognized by the California Department of Fish and Wildlife (DFW) as a species of special concern due to substantial reductions in the species' geographic range and numbers (Airola and Williams 2008).

We previously reported a consistent decline in the Sacramento Purple Martin nesting population from 2003 through 2009 (Airola and Kopp 2009) and then a slowing of the rate of decline during 2010-2012 (Airola and Kopp 2011). Here we report on a dramatic decline in the nesting population in 2013, and a new predation threat that may accelerate the decline in the future. We also discuss statewide implications of this and other apparent declines in other populations in California.

STUDY AREA AND METHODS

As we have annually since 2002, we surveyed for nesting pairs of Purple Martins at bridges in the Sacramento region (Sacramento, Yolo, and western Placer counties) that had been previously identified as occupied or suitable for use by the species. Colony locations and other suitable sites, and the criteria used to define them, were described by Airola and Grantham (2003), Leeman et al. (2003), and Kopp and Airola (2007).

To count nesting pairs, we mapped holes in which martins nested and recorded diagnostic breeding behaviors (i.e., carrying food to nests, removing fecal sacs, begging by nestlings, and nestlings perched at hole entrances; Airola and Grantham 2003, Leeman et al. 2003). These methods provide a consistent and repeatable basis for estimating the nesting population. We confirmed breeding of 96% counted pairs through observation of diagnostic breeding behaviors in 2013. Nesting by the other 4% of pairs, which apparently failed before nestlings or diagnostic behaviors could be detected, was inferred based on nest building and subsequent frequent hole entry by pairs (see Airola and Grantham 2003).

RESULTS

Colony Occupancy and Nesting Population Status

In 2013, Sacramento region Purple Martins nested at seven colony sites (Table 1) the fewest number since systematic monitoring of the population began in 2002 (Airola and Kopp 2011). This number compares to 11-12 colonies occupied during 2003-2008 and nine colonies during 2009-2012 (Table 1). Two occupied sites that were abandoned in 2013 were 20th St (in Highway 50 in Sacramento) and Taylor Rd (in Highway 65, Placer County). Our historical research has shown that 20th St was occupied regularly as early as 1976 (Airola and Grantham 2003) and continuously since we began annual monitoring in 2001 (Airola and Kopp 2011, Airola unpub. data). The nesting population there, however, had been steadily declining since 2005 (Table 1). Taylor Road was abandoned in 2013 after this previously occupied and abandoned site had been re-colonized by a pair with a second-year (SY) male in 2012.

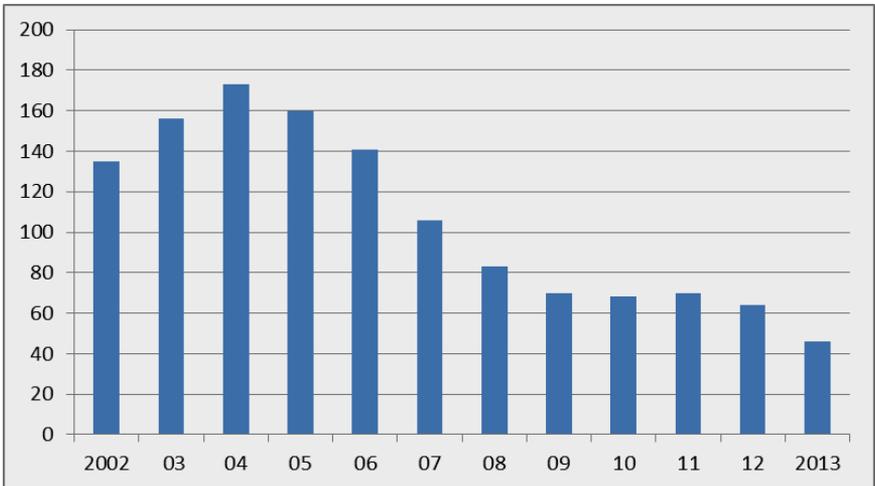


Figure 1. Number of nesting pairs of Purple Martins at colonies in the Sacramento Region, 2002-2013.

Forty-six pairs nested at Sacramento colonies in 2013, representing a 28% population decline from 64 pairs in 2012. This decline is the highest rate of annual loss in the Purple Martin population since intensive monitoring began in 2002 (Figure 1). Overall, the martin nesting population in Sacramento has declined by 73% from its high of 173 pairs in 2004.

Declines in nesting pairs between 2012 and 2013 occurred at five colonies. Small increases (1 pair each) occurred at two colonies and one colony had stable numbers (Table 1). Two colonies, Sutterville and Redding

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

^ans= not surveyed.

Table 1. Number of breeding pairs of Purple Martins in the Sacramento region, California, 2002–2013.

Avenue, support 50% of the remaining population. Three colonies supported nesting populations of three pairs or less. In the past, such low numbers at a colony led to site abandonment in subsequent years (Table 1).

Kestrel Predation at Nesting Colonies

In addition to the dramatic decline in the nesting population, Purple Martins in 2013 encountered a new threat in the form of predation by American Kestrels (*Falco sparverius*). Kestrels have been known to nest annually immediately adjacent to the Sutterville and Redding Road colonies since at least 2009 (Airola and Kopp, unpublished records in ebird.com), but no predation of martins by kestrels had ever been observed. We discuss predation observations and martin response at each of these two colonies.

Redding Avenue Colony. American Kestrels were observed regularly during the breeding season at the Redding Avenue Purple Martin colony since 2009, and had nested for several years prior to 2013 in a hole in a nearby building. Although martins often sounded alarm calls when kestrels approached martin nest sites, we observed no evidence of martin predation by kestrels in over 60 visits annually to the colony before 2013.

In 2013, Kopp observed kestrels regularly after martin colony monitoring began on 16 March. He first observed kestrels entering "weep hole" entrances to the bridge nesting chambers on 26 May, when various martin pairs were nest-building and some were likely incubating. Martins attacked kestrels beneath or adjacent to the colony on at least 15 subsequent visits. Over the season, kestrels were seen entering at least six weep holes that were not occupied by martins, and one kestrel was observed attempting to enter an active nesting hole, but was driven away by martins and human monitors. On 23 June, Kopp found the clipped wings of a adult male martin, as is typically done by raptors. The next day he found four dead nestlings below another hole. Mass "fallouts" such as this typically happen when adults stop attending the nest. Thus, it appears that predation on at least one of the nesting pair caused nesting failure. At least two other nests failed after the nest building period, but we cannot be sure that the cause was predation.

The Redding colony also supports a sizable nesting population of White-throated Swifts (*Aeronautes saxatalis*). Some of the holes not used by martins that were entered by kestrels likely were occupied by swifts. Kestrels were observed capturing or feeding on swifts during five visits in 2013.

Sutterville Overpass Colony. Kestrels were first noted nesting adjacent to the Sutterville colony in 2010 and were observed there during the 2011 and 2012 nesting seasons.

In 2013, Airola first observed a kestrel near the Sutterville colony on 16 March, and observed a pair copulating on 18 March. Kestrels were seen regularly during subsequent monitoring in April through June, and a pair

successfully nested in a wooden utility pole 60 m north of the Sutterville colony. Characteristically, martins were first seen at the colony in early April 2013 and began nest-building at the colony in early May.

On 26 June, Kopp observed a kestrel entering an active martin nest hole at Sutterville and then flying out with a nestling. The adult martins chased the kestrel as it flew away with the nestling and later attacked it when it tried to re-enter the same nest hole. Kopp observed a kestrel trying to enter the same hole daily during 27-30 June, and hovering under other occupied holes.

In the morning of 28 June, Airola saw martins entering seven nest holes; nestlings could be heard calling in two holes (indicating they were more than about 12 days old) and adults carried food to nestlings in two others. A kestrel was present, but he observed no attacks on martins during 30 min at the site. On 29 June six holes were active (two with food deliveries and one other where removal of a nestling fecal sac was seen). A kestrel carrying a lizard was attacked by five martins and took the prey to a recent kestrel fledgling nearby. It then returned and flew beneath the martin nesting colony twice, being attacked by 10-15 martins each time. Later that evening, Kopp observed an adult martin carry food into a nest hole and then a kestrel attempt to enter the same hole; the kestrel was driven off by martins and Kopp. Subsequently, martins attacked a kestrel under the nesting colony on 2 July. On visits on 2, 4, 7, and 14 July, no martins were present at the colony.

The lack of martins at the Sutterville colony after 2 July suggests that nesting was disrupted. The stage of nesting on 29 June, as indicated by timing of previous nest building and observations of nest behavior (i.e., older young seen or heard in nest holes; see Figure 2), indicates that young from at least three pairs may have been close to fledging age at this time, but that many of the other seven pairs present likely were not. One family group of at least one adult and three HY martins seen on 7 July about 1.9 km WSW of the colony

Figure 2. Purple Martin nestlings, about 20 days old, looking down out of nest site in the underside of a Sacramento overpass. Nestlings at this age wait for food deliveries at the hole edge and call frequently, which may attract predating kestrels. Wire mesh ring is a "nest guard" we installed to create a railing on the inside of hole, to reduce fallout by nestlings.



likely represents a successful nesting from Sutterville, since it is considerably closer than the next closest colony (the I St colony, 5 km away). The lack of martins at the colony during early July when many of the nests at Sutterville likely had nestlings that were too young to have fledged, and when many nests at other Sacramento colonies still had nestlings, suggests that kestrel predation either eliminated nesting directly through predation or caused nest abandonment before fledging occurred in as many as seven nests.

Attempt to Control Kestrels. Soon after we observed predation, we arranged with several experienced raptor biologists to capture the kestrels, using a captive Great Horned Owl (*Bubo virginianus*) as a lure, for relocation away from the colonies. We then contacted both DFW and U.S. Fish and Wildlife Service (USFWS) and requested approval to capture and relocate the kestrels. Both agencies rejected the request. DFW said that under existing law it could not authorize predator removal to benefit a species not listed as threatened or endangered (K. Thomas, pers. comm.). A USFWS Migratory Bird Permit Office representative also stated that it "cannot authorize removal of predators to protect non-threatened/endangered species", and "We prefer not to interfere with natural predator-prey relationships even with threatened/endangered species and would rather let natural selection occur" (J. Brown, pers. comm.).

After-second-year male Purple Martin carrying food to nest site in Sacramento bridge, 21 July 2010" Photo © Dan Brown.



DISCUSSION

Population Decline

The rapid decline in the number of Purple Martin nesting colonies and the size of the nesting population in 2013 increases concern for this small,

isolated, and remnant population. The population is at its smallest size in 16 years of monitoring that we have conducted since 1992 (Airola and Grantham 2003, Airola and Kopp 2011). We calculated a rate of decline of 60% for the period of 2004-2009 and projected that at the average annual rate of decline of 16%, the population would be extirpated within 22 years (Airola and Kopp 2009). Although the rate of the decline slowed to an average of 2.9% annually during 2010-2012 (Airola and Kopp 2011), the 28% decline in 2013 brought the average rate of decline over 2004-2013 back to 16%. Therefore, the Sacramento Purple Martin population remains on a downward trajectory. If this rate of decline continued at this rate, the nesting population would decrease to only 8 pairs within 10 years, and complete extirpation would occur within 17 years (i.e., by 2030). This rate of decline, however, does not consider the likely higher mortality rates at colonies as they became smaller and especially the effects of the kestrel predation which only manifested itself late in the 2013 nesting season. Therefore, the future rate of population decline is likely to be even more rapid than this projection suggests.

The combination of continued long-term decline in the nesting population, fragmentation of a number of colonies into potentially non-viable units, and the new threat of nest predation by kestrels accelerates already dire concerns about the future of the Sacramento Purple Martin population. At this point, it may well be that the population is too small to maintain resiliency against the pervasive threats. As one of only two Central Valley populations, and the only sizeable one (Airola and Kopp 2011, Sylvester and Airola 2010), the loss of this population would substantially reduce the likelihood of any future recovery of the species in the large Central Valley portion of California.

Predation Effects

The Sacramento Purple martin population has been shown to be sensitive to changes in habitat conditions, including increases in train and car traffic, loss of flight access to nesting areas, loss of perch sites, loss of nest material collection areas, and feral cat predation. Before 2013, predation by raptors has generally been infrequent and considered of little or no importance to the population (Airola and Kopp 2007, 2009; Kopp and Airola 2012).

Kestrel predation in 2013 appears to have disrupted reproduction to some extent at both the Redding and Sutterville colonies. We were unable to directly access nest sites to determine reproductive success, but our observations show that kestrels were frequently present during the nestling period and perceived by martins as threats at the colonies. Although we do not have quantitative data, we believe that the threat of kestrel predation caused martins to spend more time in nest defense than otherwise would have been used to provision young. The observation of direct predation during our relatively brief visits to sites and the apparent abandonment of

nests during the height of the nesting period suggests that more unobserved direct predation could have occurred or that predation caused abandonment of active nests. These potential predation effects further stress this rapidly declining population.

Therefore, in addition to a precipitous decline in number of pairs attempting to nest in 2013, kestrels appear to have caused substantial loss of reproduction in the 2013 nesting population. Studies and abundant anecdotal observations elsewhere show that nesting colonies that suffer significant predation are often abandoned in subsequent years (Cousens, pers. comm., <http://www.purplemartin.org/main/toptwelve.html>). Therefore, we expect abandonment by many Sacramento martin pairs of these two largest colonies in 2014, presumably through relocation to other colony locations. Our work has shown that larger colonies are more persistent from year to year than smaller ones (Kopp and Airola 2011). Therefore, predation-forced dispersal of martins from these two largest colonies, to relocate at other colonies with few pairs or even to currently unoccupied sites, may accelerate decline further from the previous pre-predation rates.

One factor that could reduce kestrel predation on nesting martins at Sutterville is the ongoing development of the adjacent 74-acre Curtis Park Village commercial and residential community. Early grading occurred during the martin nesting period in 2013 without observable disturbance to the colony. Much of the remaining weedy area that served as kestrel foraging habitat should be eliminated before the 2014 nesting period. Therefore, kestrels may not occupy the site in 2014. On the other hand, however, erecting buildings onsite also could partially obstruct the martins' flight access to the Sutterville nesting area. This issue was raised during the project Environmental Impact Report for the project, but was ignored by the City of Sacramento. The outcome for the Sutterville colony in 2014 is highly uncertain.

Effectiveness of Predator Control as a Martin Conservation Tool

Perhaps the kestrels predating on martins at the Sutterville Rd. and Redding Ave. colonies could not have been captured for removal. The inability of DFW and USFWS to grant permission to address the kestrel predation threat, however, ensured that predation was allowed to continue at these two largest remaining martin nesting colonies. In describing the purpose of designating species as state species of special concern, Shuford and Guepel (2008) noted that

"... a high priority should be placed on protecting natural processes and species, subspecies, and distinct populations that are nearing endangerment because of declining populations or vulnerability to threats. Success will be enhanced if efforts are intensified before populations decline further..."

Clearly, the Sacramento Purple Martin population is not depending on "natural processes", and in fact depends on artificial conditions in its highly urbanized environment. Yet they are a distinct and the last sizable Central Valley population that is clearly nearing extirpation and has received minimal conservation efforts from responsible agencies. Despite our considerable private volunteer efforts to understand the species' biology and apply conservation measures, the population has not responded.

An important question is whether the isolated Sacramento population of the Purple Martin is just too small and under too much pressure to survive. Banding studies during 2003-2009 showed that adult mortality rates were substantially higher than in other stable populations, presumably due to high rates of vehicle collisions (Airola and Kopp 2007, Airola, unpub. data). Threats to habitat suitability through development and highway bridge modification continue at several sites. The addition of kestrel predation to an already precarious situation suggests that the Sacramento Purple Martin population has become a breeding "sink" (i.e., cannot reproduce at a rate to offset mortality) Certainly, all our conservation efforts to date have not secured the population, and we did not have any immediate solutions to the longer term issues affecting the population even before the kestrel threat developed.

Implications for the Statewide Purple Martin Population

The continued rapid decline of the Sacramento Purple Martin population raises concern about the status of other martin populations and the species as a whole in California. At its peak in 2004, the Sacramento population represented 9-20% of the estimated statewide population of 900-1,850 nesting pairs (Airola and Williams 2008, Airola and Kopp 2009). The decline by 127 breeding pairs there since 2004 represents a decline in the statewide population by 7-14%. Sacramento represents one of only four Purple Martin populations in northern California for which any long term monitoring is available to assess trends (Airola 2009). Although the other three populations showed general signs of stability when surveyed in 2008, extensive data exist only for the population at Shasta Lake (Lindstrand 2008, unpubl. data). In addition, these four populations support only about 6-12% of the remaining statewide population. Based on evaluation of occupancy of colonies between the 1990s, early 2000s, and late 2000s, Airola (2009) concluded that only those Purple Martin populations in the North Coastal region of the state appear to be numerous and healthy.

More recent declines also have occurred during the last few years at Shasta Lake and Lava Beds National Monument. The number of breeding pairs at Shasta Lake declined from 2012 to 2013 by 37% (from 27 to 17; L. Lindstrand, pers. comm.). Lava Beds, where martins have been known to nest at numerous sites since the 1950s (Lund 1977, Williams 1988, Airola 2009) did not support any nesting pairs in 2012 or 2013 (A. Ellinger, pers. comm.).

Therefore, although the nest colony conditions in urban Sacramento are somewhat unique, the continued decline of this martin population cannot be dismissed as an anomaly.

If the apparent inexorable decline of Sacramento Purple Martin population cannot be reversed, the only conservation benefit of our work may be in increasing awareness of the fragility of the species' status in the state. Current status assessments of California Purple Martins consist of a few relatively fragmented efforts conducted by a variety of private individuals with limited agency and nonprofit support. The general lack of recent information on the statewide status of the species, and the indications of declines in the few monitored populations, suggests a strong need for responsible management entities to support a coordinated effort to more fully determine the status and management needs of this largely ignored species. Previous efforts to advocate for such an assessment have resulted in only limited support from USFWS (Airola 2009).

Using the past as a guide, it appears the Purple Martin will not receive needed protection and recovery management, and will continue to decline, unless it is listed as threatened or endangered. Due to the lack of comprehensive monitoring, however, sufficient information may not exist to support a petition to list the species. The burden to prove that endangered status is warranted appears to have substantially increased in recent years, and thereby slowed the pace of other species' listings. Will the lack of commitment on the part of agencies and statewide conservation organizations to determine the current California status of the Purple Martin, and the greater burden of proof required to list the species, result in no action for the species until it becomes unrecoverable statewide, as now appears to have occurred in Sacramento?

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