Occurrence Patterns and Behavior of Purple Martins at a Breeding Season Roost Site in Sacramento, California

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The Purple Martin (*Progne subis*) has declined precipitously in the Central Valley of California since the 1970s (Airola and Grantham 2003) and elsewhere in California, where it is recognized as a state species of special concern (Airola and Williams 2008). The population of Purple Martins that nests in elevated freeways and longer overpasses in Sacramento, the last sizable remnant nesting population in the Central Valley, has declined by 63% during 2004 to 2012 (Airola and Kopp 2011).

We have studied many aspects of population biology and ecology of the breeding Sacramento Purple Martin population at their nesting locations, including nesting population size, nesting phenology, survival and mortality, reproductive success, habitat use, and responses to lands uses and human activities (Leeman et al. 2003; Airola and Grantham 2003; Airola and Kopp 2007, 2009; Airola et al. 2008, 2009). In contrast, little is known about the ecology of breeding Sacramento martins when away from their nest sites. Also, essentially nothing is known about post-breeding ecology of this population, nor for Western martins as a whole, except recent work on migration routes and wintering areas of a few birds (Stuchbury et al. 2009, Frasier et al. 2012).

Immediately before and during their post-breeding migration, martins in eastern North America are well known to congregate, often in groups of many thousands, at roost sites away from nesting areas (Russell et al. 1998). Night roosting in large numbers away from colonies also has been reported throughout the breeding season for martins nesting in the desert southwest (Cater 1944) and in the eastern U.S. but is not well understood (Tarof and Brown 2013). Purple Martins are known to return to roost at night at nesting colonies for several weeks prior to migrating (Tarof and Brown 2013, Kopp, pers. obs). The behavior of martins during the period just after fledging and before establishment of premigratory night roosts, however, has not been well studied despite the fact that this period could be important in determining recruitment of young into the future nesting population.

In April 2010 during general birding, Kopp discovered an area used by Purple Martins away from Sacramento nesting colonies at Paradise Beach

along the American River in Sacramento in late July through mid-September 2010. He began frequent visits to the site during April 2011 and continued observations through September that year and again in April-September 2012.

This paper summarizes observations on the numbers and uses of the Paradise Beach site by Sacramento Purple Martins during and subsequent to the breeding period. We provide information on martin numbers over the season, roost site characteristics, and observation of behaviors including fledgling care, collection of clam shells, drinking, and reaction to predators. We also suggest possible reasons for selection of this site and the possible source nesting colonies for this martin aggregation. Such information contributes to the knowledge of the ecology and habitat use and may aid in conservation efforts for this highly imperiled population.

STUDY AREA

We made observations at the Paradise Beach area, adjacent to Glenn Hall Park along the American River Parkway in Sacramento County, California. The site consists of a wide river meander with a low floodplain that is regularly inundated at annual high flows of the American River in wet periods and exposed when the river recedes. During the period of martin occurrence in April through September, flow releases at upstream Folsom Lake and Lake Natoma vary from 2,000-13,500 cu ft/second (http://www.dreamflows.com/graphs/yir.076.php). In addition to the river itself and an open area of bare, exposed sandy floodplain, the area supports woodland and scrub comprised of Fremont cottonwood *(Populus fremontii*), several willows (*Salix* sp.) white alder (*Alnus rhombifolia*), box elder (*Acer negundo*), and valley oak (*Quercus lobata*). An electrical transmission line that traverses the northeast side of the river bend was the major roost site used by the martins (see Results). The area is a popular use area for recreation and both on-leash and illegal off-leash dog exercise.

METHODS

Kopp collected nearly all observations reported and summarized here. Surveys for Purple Martins occurred on a total of 112 visits to the area in 2010 (28 July through 1 September), 2011 (29 April through 11 September), and 2012 (20 April through 4 September). Average duration of surveys was 58 minutes. Many of the initial 2010 and early 2011 trips were generalized birding visits where we walked around a large area rather than concentrating on the Purple Martins. In the early part of each season (mid-March to mid-June), from before nest initiation to when nestlings fledged, we visited the site whenever possible without targeting a particular time of day. After young began to fledge from nesting colonies in mid-to late-July, we mainly conducted more focused surveys from a site across the American River from

the transmission lines and metal towers where martins regularly perched. We also concentrated surveys during evening hours as this was determined to be the time when the most birds were present (see Results).

During monitoring, we regularly recorded information on total numbers of martins present, the presence of hatch-year (HY) birds (i.e., those fledged earlier during the same year as observed), characteristics of perch sites and other used areas, and various behaviors observed, including adult feeding of HY birds, drinking, collecting clam shells, responding to potential predators, and flight directions to and from the roost area. We could often detect HY birds based on plumage or behavior (i.e., begging for food, being fed by adults, uncoordinated landing and perching, and landing in trees where adults generally did not). Due to our distance from the primary perch site, however, we did not believe we could consistently distinguish between adult and second-year (SY) females, SY males, and HY birds. Therefore, we did not attempt to separately make and report counts of HY birds.

Distances were measured using Google Earth (earth.google.com).

RESULTS

Roost Site Characteristics

The primary substrate used for perching was the transmission line located approximately 50 m from the northeast bank of the American River. Martins perched most often at a height above 35 m on a single transmission tower and adjacent conductors (lines), but also on adjacent conductors and two additional towers within a 600 m long section. Some martins, especially HY birds, occasionally perched in cottonwoods below the power lines and along the bank of the river. Surrounding vegetation consists of willow-cottonwood riparian forest and scrub, sandy floodplain beach and ruderal scrub and herbaceous habitat, and adjacent residential development.

The roost site was centrally located relative to nine surrounding nesting colonies in bridges occupied regularly by martins in 2010-2012 (Leeman et al. 2003, Airola and Kopp 2011) at a distance of 3.1 to 7.4 km away (average=5.0 km). Directions from the roost area to colonies ranged between due north through northwest, west, southwest, and south. No colonies have been located during extensive searches of suitable habitat anywhere to the east of the roost.

Occurrence Rates and Abundance

We detected Purple Martins at Paradise Beach in all months between April and September and on 58 (59%) of surveys in 2011 and 44 (65%) of surveys in 2012. Among surveys when martins were present, they were more abundant during the evening (>16:00 hrs; average=19 martins, N=97) than in the morning (<10:00, average=5, N=5) or mid-day (10:00-16:00, average=3, N=11). In both years, the frequency of observation at Paradise Beach

increased over the season, from May (64% of 22 surveys) and June (65%, N=17) through July (85%, N=27) and August (91%, N=53).

Purple Martin family groups with dependent HY young (i.e., begging or being fed by adults) were first seen with adults in mid-to-late July (28 July in 2010 and 2011, 18 July in 2012), and continued to be seen through late August and early September (11 September in 2011, 20 August in 2012). Over the period when they were seen at the site, they were observed on nearly one-third of all surveys (34% in 2011, 35% in 2012, N=32 and 26, respectively).

Dependent HYs were present later in the year in 2011 (28 July-11 September) and for longer (45 days) than in 2012 (18 July-22 Aug; 35 days). This relatively long period of occurrence of HYs, which are typically dependent on adults for only 7-10 days after fledging (Tarof and Brown 2013), likely reflects differential timing of nesting and subsequent fledging of young by ASY vs. SY birds (Tarof and Brown 2013, Kopp and Airola, unpub. data).

Patterns of Purple Martin abundance at the site reflected the pattern of seasonal frequency, with lower abundance in May (average=7 martins per visit) and June (average=6), highest abundance in July (average=36), and then a decline during August (average=19). Numbers increased rapidly in late July. The highest period of abundance was 24 July-9 August, with an average of 49 martins per visit (N=27 surveys). The highest numbers observed during each of the years 2011 and 2012 occurred in late July, with 92 martins on July 27 in 2011 and 95 on 31 July in 2012.

Habitat Use and Behavior

Drinking. Martins were observed drinking from the river surface while on the wing during 39% of the 80 surveys conducted after 23 July in 2011 (when Kopp began recording this behavior) and during the entire monitoring period in 2012.

Clam Shell Collection. Martins regularly collected small clam shells, presumably of the Asian freshwater clam (*Corbicula fluminea)* on an open sandy area that is inundated annually during high flows, but exposed during the period of martin occurrence. Over 2011 and 2012, martins, mainly females, were observed collecting shells in over one-third of observations in mid-July to mid-September 2011 (37%, N=27) and 2012 (38%, N=21). This period corresponds to the period from when nestlings are being fed in nests through the post-nesting period.

Response to Potential Predators. We observed martins responding to a large number of potential predators and competitors during visits. Martins chased and attacked Peregrine Falcons (*Falco peregrinus*) twice, and a Cooper's Hawk (*Accipiter cooperi*), Red-shouldered Hawk (*Buteo lineatus*), Swainson's Hawk (*Buteo swainsoni*), and American Kestrel (*Falco sparvarius*) once. Cooper's hawks elicited alarm calls but no attacks on two other occasions.

Non-raptors elicited martin responses several times. American Crows (*Corvus brachyrhynchos)* elicited alarm calls twice when flying by the roosting area. Martins once attacked and chased a Green Heron (*Butorides virescens)* when it landed beneath the roost area. A Western Kingbird (*Tyrannus verticalis*) and martin battled aerially once. We observed no predation attempts on martins.

Responses to Human Activity. The transmission tower with the highest Purple Martin use on the east side of the American River was located 10 m from the paved American River Parkway trail, which received high use by bicycle riders and pedestrians. The American River receives low use by non-motorized boaters (present on <5% of visits). The adjacent area on the west bank of the river received nearly continuous human activity included hiking, dog exercising (including frequent illegal off-leash use) and occasional organized sports (beach volleyball). Martins generally did not appear to be disturbed by the human uses in the area, presumably because the transmission lines and towers used as a perch are high and across the river from most human use, whereas most bird use consists of perching or flying. Martins were occasionally disturbed by humans and dogs when on the ground collecting clam shells.

Flight Direction. We did not keep detailed records of directions from where martins flew into and departed from the roost site. Generally, martins leaving the site flew in a westerly and southerly direction, where most of the nesting colonies are located. No martins were seen flying north, where one colony is located. No birds were seen flying east, where no colonies are known.

DISCUSSION

These observations at this roost site supplement abundant observations at nest sites and therefore provide a more complete picture of the ecology of the Sacramento Purple Martin population during the nesting and post-nesting periods. Use of the perch site may facilitate social interactions among the Sacramento metapopulation, and may be a precursor to formation of post-breeding pre-migratory roost sites, which are common in the larger eastern Purple Martin population (Tarof and Brown 2013) but as yet largely undocumented among martins in western North America.

Although we cannot completely dismiss the possibility that some of the martins at the Paradise Beach site were from populations other than the Sacramento breeding colonies, we believe this to be unlikely for several reasons. First, most martin observations occurred during and immediately after the nesting period when populations elsewhere should still be nesting. Southbound migrants from other nesting populations tend to breed later than Sacramento martins due to cooler summer temperatures along the coast, at higher elevations in the Sierra Nevada, and at more northern latitude (Airola

2009). Also, based on distance alone, the closest known nesting populations, in Nevada and Yuba Counties in the northern Sierra Nevada and in Lake County in the Coast Range, are all >85 km from Paradise Beach. Martin groups with dependent HY birds, as were many of the group we saw late in the season, would not have been traveling such distances from nesting colonies elsewhere at that stage in the nesting cycle. Also the fact that the martins did not roost through the night, but rather departed near dusk, suggests that they were local birds still returning to natal colonies to roost for the night.

Difficulties in assigning roosting martins to age classes for counts, especially separately counting numbers of HY versus SY and after second-year (ASY) birds, prevent a clear determination of the number of nesting pairs and their offspring from the Sacramento population that may be using the site. Peak counts of >90 individuals suggests that at least 20 nesting pairs each with 2-3 young-of-the-year could have been using the site simultaneously. More likely a greater number of pairs than this estimate were using the site at different times and days. Considering that the largest colony during both 2011 and 2012 supported 20 pairs (Airola and Kopp 2011), it seems likely that the site is being used by birds from multiple colonies. Even the conservative estimate of use by 20 pairs indicates that the site is used by at least 30 percent of the Sacramento nesting population in 2011 (70 pairs) and 2012 (64 pairs).

Why martins from surrounding colonies use the Paradise Beach site is not known with certainty, but several factors are suggestive as causes.

- The site is centrally located among the active nesting sites. It appears likely that congregation of martins from various colonies serves a social purpose, and a centrally located aggregation site facilitates such congregation.
- Based on the behaviors observed and the frequencies of behaviors, the presence of water for drinking likely contributes to the selection of the Paradise Beach site. Many of the Sacramento nesting colony sites are not adjacent to an accessible water source (average distance=2.6 km, range=0.2-6.1 km). While Paradise Beach is the closest access to the American River for two colonies (within Highway 50 at 35th and T St., and in near Highway 80 near Roseville Rd), these colonies hosted an average of only 12 pairs annually, thereby suggesting that martins from other colonies bypass their nearest water source to travel to Paradise Beach.
- The presence of the large open floodplain area provides a safe place to acquire ample supply of small clam shells, which may serve as a source of grit or possibly calcium for egg formation and skeletal development of growing nestlings (Tarof and Brown 2013).
- The transmission line provides an ample area for perching in a high, open area where predators can be readily detected and challenged.

- Finally, human activity does not appear to conflict with most martin uses of the site.

Although we cannot say for sure why the site is important, the fact that it is used regularly by a large number of martins that travel 3-7 km from nesting areas to gather there indicates that it is important to the population.

The transmission line and other use areas are all within the American River Parkway, which is managed by the County of Sacramento as a dispersed use area and The Bushy Lake natural area of Cal Expo (part of the state-owned State Fair property.) We are not aware of any proposed or approved land use projects that would threaten continued use of the area by Purple Martins.

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