

Purple Martin, *Progne subis*, in San Luis Obispo County  
Riparian Habitat: Presence, Persistence, Nesting,  
Brooding and Reproductive Success

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## Table of Contents

Abstract	1
Introduction	1
Purple Martin Characteristics	1
Historical Range	3
Current Range	3
Migration and Breeding	4
The Issue Facing Purple Martins	5
Threats to Purple Martins in California	6
Project Objectives	8
Hypothesis	8
Experimental Procedures and Methods	9
Site Selection	9
Site Maps	11
Tree and Cavity Maps	12
Tree 1	14
Cavity 1A	14
Cavity 1B	15
Cavity 1C	16
Cavity 1D	16
Cavity 1E	17
Cavity 1F	18
Tree 2	18



Cavity 2A	19
Tree 3	20
Search Methods	21
Purple Martins Present	22
Purple Martins Persistent	22
Purple Martins Nesting	22
Purple Martins Brooding Young	24
Purple Martin Reproductive Success	24
Table of Methods	25
Results	25
Discussion	30
Literature Cited	35

# Purple Martin, *Progne subis*, in San Luis Obispo County Riparian Habitat: Presence, Persistence, Nesting, Brooding and Reproductive Success

## **Abstract:**

The State of California, as of 2002, identified the Purple Martin as a bird species of Special Concern (Airola et al., 2003). These migrants were historically found in a unique habitat in Central California; nesting in natural cavities of Western Sycamores within Riparian Habitats. I am proposing that Purple Martins still successfully nest and brood young in this unique habitat in San Luis Obispo County. The primary study site is in Atascadero where Highway 41 meets San Gabriel Road and San Gabriel Road crosses Atascadero creek. The secondary site is Highway 58 in Santa Margarita where the highway crosses the Salinas River. After making observations from March 15<sup>th</sup>, 2009 to June 15<sup>th</sup>, 2009, Purple Martins were only confirmed present at the secondary site. The primary site in Atascadero had confirmed nesting in four separate cavities in Western Sycamores.

## **Introduction:**

### Purple Martin Characteristics:

Purple Martin, *Progne subis*, are the largest swallow. Adult males are entirely glossy blue-black. The males are the only dark bellied swallow in North America. Yearling males resemble females in their plumage but also show variable amounts of blue-black feathering on the head and underparts. The male yearlings are generally lighter below and more brown than blue. Purple Martin females resemble other swallows in their coloring but are differentiated by

their large size. Females have a pronounced brownish or grayish collar around their nape and also have less contrast between their chest and undertail coverts (Brown, 1997).

Purple Martins are a socially monogamous species (Brown, 1997). Males and females who are socially monogamous do not have to include any sexual exclusiveness because socially monogamous is not sexually monogamous. Extra pair copulation do occur in Purple Martins populations, where the birds form breeding pairs to mate and raise offspring, but do engage in sexual activities with partners other than their primary mate. The extra pair copulations usually occur while females are away from the nest collecting nest material and are attacked by another male (Brown, 1997). Also, both males and females defend the area around their nest cavity with a radius of 20 to 30 meters and have even been found defending cavities that were not their nesting cavity (Stutchbury, 1991).

The birds' main food is flying insects (Brown, 1997). They are most active before 11:00 and after 17:00 in nesting locations in the riparian habitat, especially on hot days (Airola et al., 2003). Purple Martins are able to feed while in flight and often at high altitudes. They fly the highest out of the swallows; at 50m and sometimes even 150m (Brown, 1997). Their ability to fly at high altitudes makes it harder to find them except at dusk when they feed closer to their nest. Also, cold and rainy weather causes them to feed lower. Purple Martins do not feed in groups either, unlike other swallows, but paired males and females can feed together (Brown, 1997).

Purple Martins also have a distinct vocalization. Their dawnsong is used in early morning before daylight; between 4:45 and 5:30 in locations of nests. It is also the loudest vocalization that is given by the species (Brown, 1997). Dawnsong is given only by males

usually while circling overhead, over nest sites, and rarely is song made by males that are perched (Brown, 1997). Dawnsong could be used to aid in locating breeding Purple Martins.

#### Historical range:

The Purple Martins were originally described as “fairly common” throughout California and some of Colorado by Grinnell and Miller (1944) (Airola and Williams, 2008). Grinnell and Miller noticed that martins were beginning to occupy urban settings, and also that the numbers of martins seemed to be increasing. Martins were recorded as nesting in the southern coastal California counties, in conifer woodlands and urban areas (Airola and Williams, 2008). However, the greatest abundance was found in the 1960s and 1970s in the coastal portion of northwest California (Airola and Williams, 2008). Breeding activity and nesting success was confirmed in these areas. Also, martins were discovered in the central coast region, in the northern central valley where they were found in urban settings. Most commonly when Purple Martins are found in urban settings they are found successfully nesting in weep holes beneath bridges. However, on the central coast unlike all other locations, the martins were found in riparian areas (Airola and Williams, 2008). Not only is the central coast unique because it is the only location in California where they are found in a riparian habitat, but also because the birds are nesting in natural cavities in the western sycamores as opposed to man made bridges or bird houses.

#### Current range:

Purple Martins are widely but locally distributed through out California. They are found mainly in woodlands, forests and urban settings in weep holes beneath bridges. Today however,

unlike historical times, Sacramento is the only urban area documented to have Purple Martins with confirmed nesting and breeding success (Airola et al., 2003).

Overall, the martin population has declined since Grinnell and Miller surveyed and the occupied range has become smaller compared to its historic wide range (Airola and Williams, 2008). However, not many studies have been able to successfully estimate the size of the population or make an accurate conclusion of where martins may be nesting. There is no significant long term population trend of Purple Martins in California (Airola et al., 2003).

The state-wide population estimate of 900 to 1350 is very rough because it is difficult to survey martins. Purple Martins are difficult to survey due to the fact that they are migratory birds that occupy so many different kinds of sites and may occupy a site only temporarily and find a new site mid-season or return to a different site the following year (Airola and Williams, 2008). It is almost impossible to know if the estimates are accurate because one could be counting the same group of birds twice if they move to a different site; underestimating martins when conducting casual surveys and; have no data on habitats that were not surveyed at all. The current estimate of the population for the state are based on records from 1980 to 1994. More current estimates are needed for the species (Airola and Williams, 2008). Specifically, there are few known sites of Purple Martin nesting in Monterey, San Luis Obispo, and Santa Barbara (Airola and Williams, 2008). In addition, these counties appear to be the last place where martins still nest in riparian woodlands, mainly in Western Sycamores.

#### Migration and Breeding:

The Purple Martin is a migratory bird. Its wintering habitat is in South America in the lowlands east of the Andes, including all the area North of Argentina and South of Brazil

(Brown, 1997). The Amazon basin serves as an austral major staging area where all the birds gather before starting their migration (Brown, 1997).

The spring arrival day for western Purple Martins is less well documented than for eastern Purple Martins. Eastern Purple Martins migrate to the east coast. Their population is much larger and not listed as a bird species of special concern. Therefore, more is known about their migration and population size. However, the Purple Martins that migrate to the west coast, specifically California, are considered a species of special concern. Their migration is not well documented due to their small population size. There is also significant uncertainty regarding their population size. The earliest arrival date is March 1<sup>st</sup>, in California; and most birds do not start returning to South America until late September (Brown, 1997). Therefore, Purple Martins occur as a summer resident in California. They are primarily found in California from mid-March to late September (Airola and Williams, 2008). They typically breed from May to mid-August. It is rare for the martins to be breeding in late April (Airola and Williams, 2008).

#### The Issue Facing Purple Martins:

Purple Martins were once considered “fairly common” in the state of California. Grinnell and Miller even reported that the population seemed to be increasing (Airola et al., 2003). Recently, Purple Martins have been considered rare to very uncommon. The state of California, as of 2002, identified the Purple Martin as a bird species of Special Concern, priority 2 (Airola, Jones and Stokes, 2003). Second priority is defined as population or range size greatly reduced or population or range size moderately reduced and threats projected to greatly reduce the taxon’s population in California in the next 20 years (Shuford and Gardali, 2008). Purple Martins were also included in both the 1978 and 1992 special concern lists (Airola and Williams,

2008). The martins were put on the bird species of Special Concern after the state of California preformed a well-documented survey and identified a drastic population decline and substantial reduction in the species geographic range (Airola et al., 2003).

#### Threats to Purple Martins in California:

On the central California coast where martins nest in riparian corridors the loss of riparian habitat and large snags continues to reduce opportunities for the martins to establish a breeding presence, and helps contribute to the martin decline (Airola and Williams, 2008). In order for the martins to be successful it is necessary for them to establish a presence. If the Purple Martins arrive at a location that has no sycamores for them to nest in they will immediately move on. This requires spending extra energy in search of a breeding location and they could even face the probability of not being able to successfully nest at all. Incremental loss of sycamore woodland from age and lack of regeneration pose a large threat. It poses a long term effect especially in those last remaining areas where the Purple Martin's habitat is riparian woodlands (Airola and Williams, 2008). Ultimately the loss of sycamores leads to the loss of nesting cavities for the Purple Martins on the central coast and in turn leads to a decreased population size.

In the southern coastal California counties, where the Purple Martins nest in woodlands logging and snag removal to prevent lighting ignitions has reduced the number of large trees that martins could nest in (Airola and Williams, 2008). Awareness of the importance of keeping the large trees for martin nesting has increased but time and time again safety and fire prevention override habitat protection for Purple Martins. Statewide, collisions with trains, cars and trucks and even predation by human-maintained cat colonies are potentially a significant

source of Purple Martin mortality (Airola and Williams, 2008). Also, pesticide effects have not been documented but also cannot be ruled out (Airola et al., 2003).

Other areas where the Purple Martins nest, in urban settings, are bridge sites, river banks, and rail lines, which have been eliminated. Also, nesting exclusion from these areas during construction projects and landscaping not only reduces the population but it discourages martins from returning to the same location the following season which means more work for the Purple Martins next season when they must search for a new nesting site (Airola and Williams, 2008). In Sacramento, where martins nest heavily in weep holes beneath bridges, the result has been help for martin nests and broods. Airola Environmental Consulting is monitoring the birds closely and taking action to ensure nesting and breeding success of the Purple Martins at weep hole sites (Airola et al., 2003).

The major suggested cause of martin decline in California is due to competition for nest holes. The Purple Martins are secondary cavity nesters, meaning they can not create or build a cavity of their own and instead occupy natural cavities, man made cavities, or bird made cavities that are no longer occupied. The Purple Martins suffer from competition with European Starlings and House Sparrows for these secondary nest sites. Detrimental effects of the starling displacement are very well documented throughout the United States. European Starling most commonly take over the nest holes after the martins migrate in late September. The starlings and house sparrows take over the cavity and make it unsuitable for martins use, because both are residents that still inhabit the cavity when the martins return the following season (Brown, 1997). This in turn makes recolonization of most areas very unlikely and extra time and effort on the martins' side to find a new nesting location, taking time and energy away from reproduction (Airola et al., 2003).



All the threats to Purple Martins act as deterministic factors that contribute to their decline. The knowledge of this decline, and the potential detrimental threats is cause enough to start early protection before the population is reduced significantly. It is within the next years that this population will either grow or continue to decay. This makes it the best time to learn as much as possible about Purple Martins and intervene with their current path.

## **Project Objectives:**

### Hypothesis:

The following is a list of nested hypotheses I tested. These are nested because the need to test a hypothesis is only justified conceptually if the previous hypothesis was rejected.

#### Hypothesis 1

Ho: I will not detect the presence of Purple Martins; *Progne subis*, in the riparian woodlands of San Luis Obispo county

Ha: I will detect at least one Purple Martin; *Progne subis*, in the riparian woodlands of San Luis Obispo County

Presence is defined as one visual or one auditory dawnsong in the study site.

#### Hypothesis 2

Ho: I will not detect the persistence of Purple Martins; *Progne subis*, in the riparian woodlands of San Luis Obispo county

Ha: I will detect at least one Purple Martin; *Progne subis*, persistent in the riparian woodlands of San Luis Obispo County

Persistence is defined as continual visuals and auditory dawnsongs for ten days or more in the study sites.

### Hypothesis 3

If Purple Martins are found persistent then:

Ho: Purple Martins, *Progne subis*, will not demonstrate any nesting behaviors in the sycamores

Ha: Purple Martins, *Progne subis*, will demonstrate nesting behaviors in the sycamores

### Hypothesis 4

If nesting behaviors are found then:

Ho: Purple Martins, *Progne subis*, will not demonstrate brooding behaviors in the sycamores

Ha: Purple Martins, *Progne subis*, will demonstrate brooding behaviors in the sycamores

### Hypothesis 5

If brooding behaviors are found then:

Ho: Purple Martins, *Progne subis*, will not have reproductive success in the sycamores

Ha: Purple Martins, *Progne subis*, will have reproductive success in the sycamores

## **Experimental Procedures and Methods:**

### Site Selection:

I visited more than one site in San Luis Obispo County. The first site was located in Atascadero at the intersection of Highway 41 and San Gabriel Road (Figure i, Figure ii).

Observations were made from the bridge on San Gabriel Road where it crosses Atascadero Creek

and from the banks of the creek. The second site was in Santa Margarita (Figure iii). I made observations where Highway 58 crosses the Salinas River.

To find a riparian area where Purple Martins have been seen in the past I conducted personal interviews with Mike Stiles and Tom Edell. Both are active bird watchers and have records of bird species accounts for San Luis Obispo County. Tom Edell explained, “that the breeding range in the county is primarily limited to the upper Salinas River watershed from Atascadero through Santa Margarita and into the Santa Margarita Ranch”. Both Edell and Stiles talked most about the site at the intersection of Highway 41 and San Gabriel Road, though the primary site is technically not part of the “primary” breeding range as defined by Edell.

At the primary site in Atascadero, the specific Western Sycamores that were observed were given numbers. The sycamore was only given a number if a Purple Martin was seen being persistent in that specific tree. Also, the sycamores were labeled further by each cavity in the sycamore having a letter assigned, going in alphabetical order. A letter was only given to a cavity if a Purple Martin was seen entering or exiting the cavity. A Martin only had to be persistent in the tree or use a cavity once for the sycamore to be labeled.

## Site Maps:

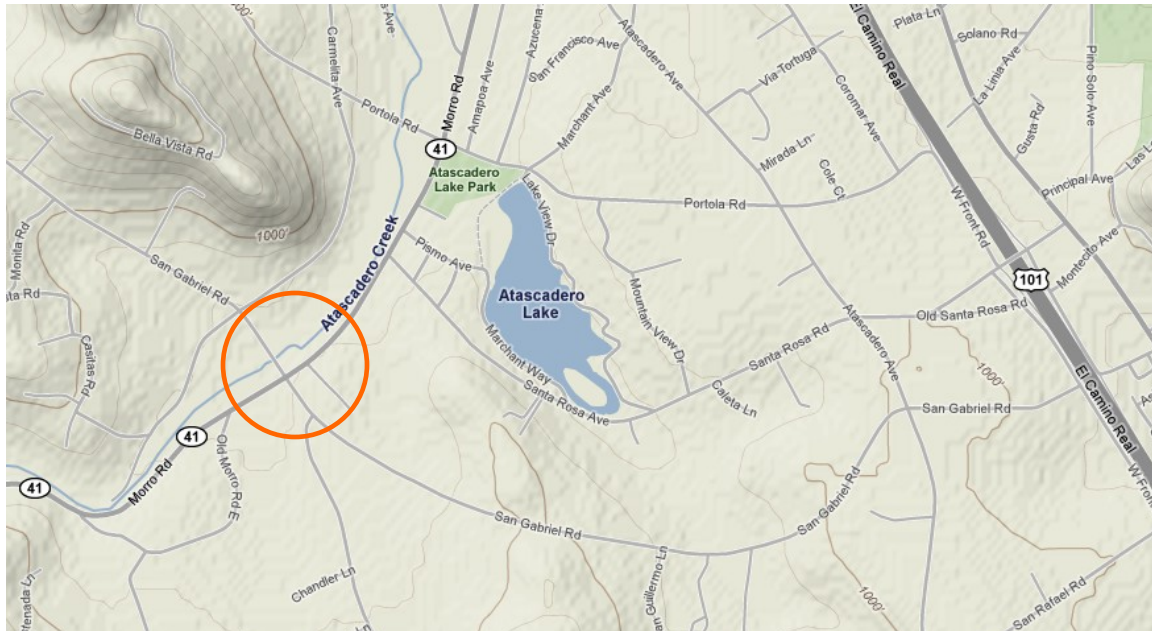


Figure i: Road map of the primary study site located in Atascadero. Highway 41 parallels Atascadero Creek and its Riparian corridor. The site is indicated by the red circle that shows the intersection of Highway 41 and San Gabriel Road.



Figure ii: An orthophoto map of the primary study site at the intersection of Highway 41 and San Gabriel Road with associated Riparian corridor. Observations will be made from the bridge on San Gabriel Road that crosses Atascadero Creek.



Figure iii: Orthophoto map of a secondary study site in Santa Margarita. The site is the Salinas River Bridge which is located on Highway 58 and crosses the Salinas River and the bridge is also the location that observations will be made.

#### Tree and Cavity Maps:

The primary site in Atascadero, at the intersection of Highway 41 and San Gabriel Road had a series of sycamores and cavities located within the sycamores that were observed. It was essential to document the location of the specific trees and specific cavities. Each tree and cavity that was assigned a number or letter was photographed and has a written description of the location for replication.





Figure iv: Aerial map of the primary site at San Gabriel Road and Highway 41 intersection. The three sycamores trees that were observed being occupied by Martins were given numbers.



Figure v: Aerial map of Highway 41 and San Gabriel Road intersection. The sycamores at the site that were observed having persistent Purple Martins were labeled with the numbers one, two and three.

### Tree 1:

On the North East corner of San Gabriel Road and Highway 41 is tree 1. Standing in between Highway 41 and the Riparian corridor, then face the riparian corridor and it is the tree directly in front of you, closest to the North East corner.



Figure vi: Photo of Tree 1



Figure vii: Tree 1 on the North-East corner of San Gabriel Road and Highway 41

### Cavity 1A:

In Tree 1 observe the three main trunks. Look at the main trunk on the left. Start at the base of the left most trunk and move up about 35 feet from the ground. The trunk branches further into three different branches. The branch on the right branches before the other two by one foot. Follow the left two branches and where the branches split is cavity 1A.





Figure viii: Cavity 1A in Tree 1



Figure ix: Cavity 1A

#### Cavity 1B:

In Tree 1 observe the three main trunks. Observe the middle main trunk, it has several smaller trunks behind it but don't follow those, follow the largest main middle trunk that is closest to you. Start at the bottom of the trunk and follow it up 30 feet. If you follow the trunk all the way up it looks as if a branch was broken off and at this location is cavity 1B.



Figure x: Cavity 1B, located at the top of the main middle trunk



Figure xi: Cavity 1B



### Cavity 1C:

Observe Tree 1 and its three main trunks. Look at the main trunk furthest to the right when standing in between Highway 41 and Tree 1. Follow the trunk from the bottom about 20 feet up, two small branches branch from the main trunk, both on the right and left side. Keep following the middle branch or main trunk and at about another foot up the trunk in branches into three and continue to follow the middle trunk another 5 feet. Then it branches into a Y and at the apex of the Y is cavity 1C.



Figure xii: Cavity 1C on the right most main trunk of Tree 1



Figure xiii: Cavity 1C

### Cavity 1D:

Observe Tree 1 and its three main trunks. Look at the main trunk furthest to the right when standing in between Highway 41 and Tree 1. Follow the trunk from the bottom about 20 feet. Two smaller branches branch off from the main trunk, one to the left and one to the right. The one on the right is larger and a different color than the rest of the tree, it is very brown in color. The branch on the right if you follow to the end of the branch is cavity 1D.



Figure xiv: Cavity 1D that is browner in color than the rest of Tree 1



Figure xv: Cavity 1D

#### Cavity 1E:

In Tree 1 observe the three main trunks. Observe the middle main trunk, it has several smaller trunks behind it but don't follow those, follow the largest main middle trunk that is closest to you. Start from the bottom and follow the middle main trunk up about 15 feet. At 15 feet there is a branch that comes off the main trunk directly towards you when standing in between Tree 1 and Highway 41. The branch is a different color than the main trunk and appears to be broken at the end and this is cavity 1E.



Figure xvi: Cavity 1E, on the middle trunk of Tree1



### Cavity 1F:

In Tree 1 observe the three main trunks. Observe the middle main trunk, it has several smaller trunks behind it but don't follow those, follow the largest main middle trunk that is closest to you. If you begin at the bottom of the trunk and move up about 20 feet there is a large branch that comes out toward where you are standing. The branch is not broken and is the same color as the rest of the tree. Cavity 1F is on the bottom or underside of the branch about 10 feet from the main trunk.



Figure xvii: Tree 1 with cavity 1F



Figure xvii: Cavity 1F on the underside of a branch

### Tree 2:

From the North East corner of San Gabriel road and Highway 41 move east along Highways 41. Stand in between Highway 41 and the riparian corridor. Follow the dirt path that begins at Tree 1 and walk East 75 feet along the path. Facing the riparian corridor, the sycamore with one large main trunk with several twisted branches coming off the main trunk is Tree 2. It is to the East of Tree 1 and to the West of Tree 3.



Figure xviii: Tree 2

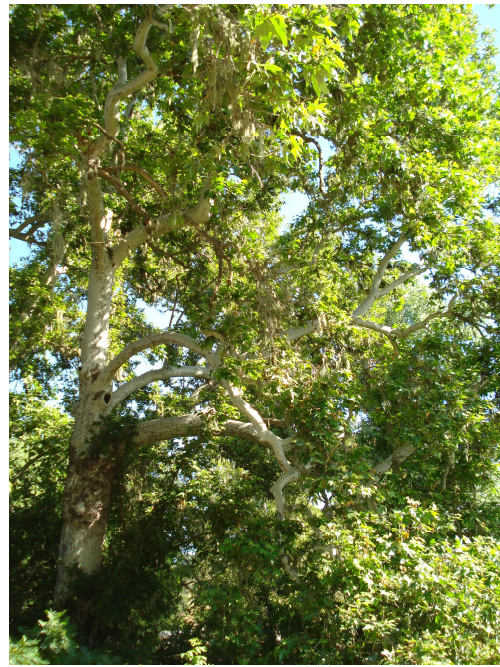


Figure xix: Tree 2 with one main trunk

#### Cavity 2A:

Standing in between the sycamore and Highway 41 you observe one main trunk on Tree 2 with several twisted branches that come from the main trunk. Follow the main largest trunk up from the bottom about 20 feet. Within the next 15 feet the trunk has three main branches all coming off to the right or east. Follow the branch out of the three that is closest to the ground. Follow that branch 5 feet and it branches further into three separate branches, one goes down directly toward the ground, one goes straight up and the middle branch has a slight downcurve or U-shape, Follow the middle branch. Cavity 2A is on the underside or bottom at the end of the branch.





Figure xx: Cavity 2A located on a main branch on Tree 2

Tree 3:

From the North East corner of San Gabriel road and Highway 41 follow the dirt path East that begins in front of Tree 1. Walk on the dirt path in between the riparian corridor and Highway 41 200 feet. Facing the riparian corridor Tree 3 is directly in between two large cottonwood trees. Tree 3 is not immediately next to any other sycamores and has three main trunks.



Figure xxi: Tree 3 located in between two large cottonwood trees

### Search Methods:

The earliest Purple Martins arrival is March (Brown, 1997). In the previous years in San Luis Obispo County the birds have been arriving around mid-March (Stiles). I started looking for Purple Martins on March 15th.

The study site located at the intersection of Highway 41 and San Gabriel Road was the primary site and I visited the site at least twice a week with at least three days in between each visit (Figure i, Figure ii). The secondary study site was where Highway 58 crosses the Salinas River (Figure iii). I only observed this site when I was testing a new nested hypothesis. How long I stayed at each site was dependent on what I observed. Also, my observations and the time I arrived at the sites was dependent on the hypothesis I was testing.

My experiment was set up very liberally; therefore I only had to observe one or two behaviors to accept the alternative and reject the null, and be able to move on to the next nested hypothesis. Also, my hypotheses applied to a single breeding pair of Purple Martins. If I only found one breeding pair of Purple Martins at my site then I could still carry out my study using the proposed methods.

My observations were recorded each visit. Although my hypotheses allow me to carry out my study with only a single breeding pair it is difficult to observe and follow a single breeding pair over the course of the study without any external identification. If I only monitored the Martins I would not be able to say with confidence that I was observing the same breeding pair over the course of my project. My observations and nested hypotheses were strictly based on observing and recording cavity use.

Purple Martins' peak breeding season is mid-April to July and they lay a single clutch per season, therefore I planned to have all my observations completed before their breeding season was over and would not miss any second attempts at reproduction because a second attempt was not expected. Therefore, I completed my observations by June 15<sup>th</sup>

#### Purple Martins Present:

For my first hypothesis, testing for the presence of Purple Martins I arrived at the site at sunrise when dawn song is most commonly heard. I listened for dawn song and looked for a visual of at least one Purple Martin. I only needed to observe one bird at the intersection of Highway 41 and San Gabriel Road to confirm the Purple Martins are present.

#### Purple Martins Persistent:

Purple Martins of both sexes spend several days to a week or more investigating nest sites after arrival and before becoming firmly established at a site or choosing a mate (Brown, 1997). Therefore, for my second hypothesis, testing for persistence of the Purple Martins, I searched for ten or more days. I arrived at the site at sunrise. I used dawn song and visuals to confirm persistence. If the Purple Martins were still persistent based on either visuals or auditory clues after ten days I would declare them persistent. And would begin to test my third hypothesis and look for nesting behavior.

#### Purple Martins Nesting:

In Purple Martin populations nest building is done primarily by females (Stutchbury, 1991). However, a diagnostic feature of gathering nest material is when either a male or female

sits on the apex of a tree branch and picks off pieces of fresh green leaves (Brown, 1997). Both males and females have been observed participating in nest defense (Stutchbury, 1991). Before egg laying birds will feed throughout the day and spend long periods of time away from the nest searching for food (Brown, 1997). Also, in a study conducted by Dan Airola in 2003, holes were considered to be occupied by a nesting pair if the adults made repeated visits to a specific hole over the course of the nesting period. A hole that was entered two or more times on two separate days, separated by more than a week during the nesting period was considered to be occupied by a nesting pair (Airola et al., 2003).

For the third hypothesis, I was looking for behaviors to confirm nesting success and the transition dates between the remaining hypotheses were dependent on whether the previous null hypothesis was rejected. I was no longer arriving at sunrise. Instead, I would arrive at the site before 11:00am or after 17:00 when the Purple Martins were most active. I was searching for birds carrying nesting material to a cavity, gathering material, and defending a cavity. Nest material included, green leaves, twigs, grass, dead leaves, and mud (Brown, 1997). I primarily watched the birds' activity and behaviors around the active cavities and would make my observations while both male and female Martins entered and exited cavities. All of these behaviors I only needed to observe once to reject the null. Other behaviors such as entering holes or entering a specific cavity needed to be observed more than once over a period of 7-10 days. I needed to observe at least two different behaviors to confirm nesting and move on to the next hypothesis.



### Purple Martins Brooding Young:

Diagnostic behaviors that demonstrate brooding behaviors are: use of a cavity by a pair, adults entering holes with food, adults carrying fecal sacs from hole, vocalizations of begging young, and visible presence of young in nest holes (Airola et al., 2003) Observations of these behaviors are essential to rejecting the fourth null hypothesis, (testing for brooding success). Another observation is a dead nestling beneath the nest which indicates Purple Martins attempt to reproduce and brooding success but does not indicate reproductive success. To collect these data, I arrived at the site before 11:00am or after 17:00 and looked for any of these behaviors. For this hypothesis test I only needed to observe one behavior one time in order to reject the null hypothesis.

### Purple Martin Reproductive Success:

My final question was testing for success of Purple Martin nesting and brooding attempts. I arrived before 11:00am and at three day intervals. I only needed to observe each behavior once and only one time to confirm the birds' success. The behaviors used to test this null hypothesis were presence of fledglings and young begging outside the cavity.

Table 1: Table of Methods

Hypothesis	Behavior	Time Span	Result
1	Visual	One Time	1 Behavior x Time Span = Accept Alternative Hypothesis
	Dawnsong	One Time	
2	Visual	10 days-	1 Behavior x Time Span = Accept Alternative Hypothesis
	Dawnsong	10 days	
3	Carrying Nesting Material	One Time	2 Behaviors x Time Span = Accept Alternative Hypothesis
	Defending a Nesting Cavity	One Time	
	Entering a Specific Cavity	7-10 days	
	Entering Holes	7-10 days	
4	Food Carry	One Time	1 Behavior x Time Span = Accept Alternative Hypothesis
	Fecal Sac Carry	One Time	
	Begging Young	One Time	
	Visible Young	One Time	
	Dead Nestlings	One Time	
5	Young Begging Outside the Cavity	One Time	1 Behavior x Time Span = Accept Alternative Hypothesis
	Fledglings	One Time	

Table 1: Table of methods which includes, each nested hypothesis, and the specific behaviors and time spans that were used to accept each alternative hypothesis. The hypotheses are nested due to the fact that a hypothesis being tested was only justified conceptually if the previous hypothesis was rejected.

## Results:

I began observations at the primary site in Atascadero, at the intersection of Highway 41 and San Gabriel Road on 15, March 2009. I arrived before sunrise and not only looked for visuals of Purple Martins in the area but also listened for dawnsong. On the first visit I did not detect any Martins.

I continued to visit the primary site before sunrise and recorded the first visual on the 23<sup>rd</sup> of March, 2009 (Table 3). There were a total of four Purple Martins and an observation of one male that entered a cavity in a Western Sycamore. I accepted my first alternate hypothesis and moved on to testing hypothesis 2 and the persistence of Martins.

By accepting my alternative Hypothesis I made the first visit to the secondary site on Highway 58 on the 24<sup>th</sup> of March, 2009. There were no Martins on the first visit. However, an avid birder in San Luis Obispo County, Maggie Smith, detected the first presence of Purple Martins at the secondary site. I accepted the alternative hypothesis for Hypothesis 1 on March 28, 2009 (Table 2). Three total Martins were seen by Smith. One male flew around, while a different male exited a cavity in a sycamore and a female was seen perched on a wire.

For the second alternative hypothesis to be accepted I needed to observe or hear Martins at the study site for ten or more days. And Purple Martins were observed at the primary site from 27<sup>th</sup> of March to the 5<sup>th</sup> of April (Table 3). Therefore I accepted my second alternative hypothesis and confirmed the persistence of Martins at the primary site.

Between the dates of March 27, 2009 and April 5, 2009 the majority of my recordings were based on visuals (Table 3). I did hear vocalizations and dawn song but they were always accompanied by a visual of the bird. Only on two separate days did I observe Martins investigating cavities. On 29<sup>th</sup> of March I observed a male and female Martin enter three separate cavities within the same sycamore. Again on April 1<sup>st</sup> I observed a male and female investigating only one cavity in a western sycamore, and April 1<sup>st</sup> was my highest count of Martins seen at one time to that date which was a total of ten Martins.

To test the second hypothesis at the site on Highway 58 I continued to visit the site at sunrise, listened for dawn song and observed for visuals. I visited the site from 1 April, 2009 to

20 April, 2009 and was unable to detect the persistence of any Martins (Table 2). Therefore, I accepted the null hypothesis and confirmed Purple Martins not persistent at the Highway 58 study site. Martins at the secondary site needed to be detected for ten or more days to confirm their persistence

7 April, 2009 I began to test the third hypothesis at the primary site in Atascadero. Between the 7<sup>th</sup> of April and the 15<sup>th</sup> of June, which was the last day of observations, I observed all behaviors expected for nesting Martins (Table 3). Also, I observed my highest count of Martins at one time on April 25<sup>th</sup>, which was 12 Martins, five were female and seven were male and there were at least ten individuals in Tree 1 (Figure vi, vii) at one time.

I accepted the alternative hypothesis for the third hypothesis on April 16<sup>th</sup>, 2009 (Table 3). However, this is the date I accepted nesting based on activity at the site as a whole; which included all the western sycamores and all the cavity use within that. The acceptance date of the fourth hypothesis based on specific cavity use varied.

At the site there were a total of seven active cavities. I confirmed nesting of Martins in four of them (Table 4). The remaining three cavities were investigated by Martins in order for them to be considered active and get a label. However, they did not meet the requirements of the hypothesis to be confirmed as a nesting cavity. The four cavities that were confirmed as nesting cavities included Cavity 1A, Cavity 1B, Cavity 1C and Cavity 2A (Figure viii, ix, x, xi, xii, xiii, xx).

Specifically Cavity 1A (Figure viii, ix) had Martins that entered the cavity from April 9<sup>th</sup> to May 25<sup>th</sup> (Table 4). Also, on 16 April, 2009 a male and female Martin were seen defending Cavity 1A against a different male and female Martin. This was enough to accept the alternative. However, for Cavity 1A no more nesting observations were seen after March 25<sup>th</sup>.

Cavity 1B (Figure x, xi) and 1C (Figure xii, xiii) were consistently used by two separate pairs of Martins from 13 April to the last day of observations (Table 4). A male Purple Martin defended Cavity 1C against a different male Purple Martin on April 13<sup>th</sup> (Table 4). On May 18<sup>th</sup>, 2009 both a male and female entered Cavity 1B, and then the male exited the cavity and returned a few moments' later carrying fresh green leaves into Cavity 1B (Table 4)

Lastly Cavity 2A (Figure xx) was not investigated by Martins until the end of April. By April 29<sup>th</sup> both a male and female in the cavity were observed defending it from a different male (Table 4). The use of the specific cavity was constant to the last day of observations.

Nesting and the third alternative hypothesis were confirmed in four separate cavities and at the primary site as a whole. By the last day of observations only nesting behaviors were being observed. There were still no sign of breeding behaviors and was therefore unable to test my fourth hypothesis and complete the series of hypotheses.

DATE	Hypothesis 1		Hypothesis 2		Hypothesis 3				Hypothesis 4					Hypothesis 5	
	Visual	Dawnsong	Visual	Dawnsong	Carry nest material	Defend cavity	Enter specific cavity	Enter holes	Food carry	Fecal Sac Carry	Begging young	Visible young	Dead nestlings	Young begging outside cavity	Fledglings
24-Mar															
28-Mar	X														
1-Apr															
5-Apr															
7-Apr															
16-Apr															
20-Apr															
15-Jun															

Table 2: Table of results from the secondary site, where Highway 58 crosses the Salinas River. Only one visual was observed at the site on March 28, 2009. Presence of Purple Martins was confirmed however, persistence was not and no further hypotheses could be tested.

DATE	Hypothesis 1		Hypothesis 2		Hypothesis 3				Hypothesis 4					Hypothesis 5	
	Visual	Dawnsong	Visual	Dawnsong	Carry nest material	Defend cavity	Enter specific cavity	Enter holes	Food carry	Fecal Sac Carry	Begging young	Visible young	Dead nestlings	Young begging outside cavity	Fledglings
15-Mar															
19-Mar															
23-Mar	X														
27-Mar			X												
29-Mar			X												
1-Apr			X												
5-Apr			X												
7-Apr							X	X							
9-Apr							X	X							
13-Apr						X	X	X							
16-Apr						X	X	X							
20-Apr							X	X							
23-Apr							X	X							
25-Apr							X	X							
29-Apr						X	X	X							
4-May							X	X							
7-May							X	X							
11-May							X	X							
15-May							X	X							
18-May					X		X	X							
21-May							X	X							
25-May							X	X							
29-May								X							
2-Jun							X	X							
6-Jun															
9-Jun							X	X							
12-Jun							X	X							
15-Jun							X	X							

Table 3: Results from the primary site in Atascadero. Results represent the study site as a whole, and recording are based on all the active cavities at the site. Presence, persistence and nesting by Purple Martins were confirmed at this site, but no observations of brooding to continue testing the remaining hypotheses.

Cavity	Hypothesis 3			
	Carry Nesting Material	Defend a Cavity	Enter a Specific Cavity	Enter Holes
1A		X	X	X
1B	X		X	X
1C		X	X	X
1D				
1E				
1F				
2A		X	X	X

Table 4: Results from Atascadero site at the intersection of Highway 41 and San Gabriel Road. Table shows observations made at specific cavities at the study site. Nesting was confirmed at four of the seven active cavities.

## Discussion:

Birds start arriving in California the earliest March 1<sup>st</sup> and most birds do not start returning to South America until late September (Brown, 1997). However, according to the bird records of San Luis Obispo County, most Purple Martins start arriving mid-March (Stiles). The arrival of Purple Martins in San Luis Obispo County that I observed was around the expected time. Arrival at the primary site was March 23<sup>rd</sup> and arrival at the secondary site was March 28<sup>th</sup>.

It is very rare for males and females to arrive in March already paired (Wiggins, 2005). Males most commonly arrive first, find a potential nest and advertise to arriving females through flight displays (Wiggins, 2005). The observations made throughout March were consistent with males arriving first. The total individuals that were seen always had more males than female Purple Martins.

Once the females arrive in the spring pair bonds form quickly, but the Purple Martins of both sexes spend several days to a week or more investigating all possible nest sites and become

more firmly established in their pair bond (Brown, 1997). The observations were of both males and females together investigating cavities as early as March 23<sup>rd</sup>. It is difficult to determine if in fact the Martins were paired and investigating cavities together or simply the female was inspecting the cavity the male had already chosen before pairing up with the male, the second matching with the expected results that Martins do not arrive already paired.

Though bonds between the males and females formed quickly, cavities were not chosen as quickly. It was essential to observe the Purple Martins at the study site for more than ten days based on the fact that Martins will spend several days or a week choosing a nesting site. At the secondary site on Highway 58, it is possible that the Martins arrived and were confirmed present and investigated possible cavities but were not satisfied and moved on to a different site and therefore could not be observed for the required time to be persistent and begin nesting.

I expected at the beginning of April after the birds had a few weeks to find a mate and select a nest site to see nesting behaviors. With the first nesting behavior being observed on April 7<sup>th</sup> it is consistent with what was expected.

Nest construction is performed mainly by the female. However, male Purple Martins do initiate building and are most commonly the only ones that retrieve and carry the green leaves during nest building (Wiggins, 2005). Although majority of nesting behaviors that were observed were consistent cavity use by a pair and defending of the nest cavity by both the male and female, a male Martin was seen entering a nest cavity carrying green leaves. On May 18<sup>th</sup>, both the male and female entered Cavity 1B (Figure x, xii) and the male exited the cavity and returned carrying fresh green leaves into the cavity. Generally seeing a pair carrying green leaves means that a nest is nearly complete and eggs are being laid (Airola).



Younger, second year birds generally take longer to nest than older adult Purple Martins. When second year birds try and nest, they start late and it is important to look for continued nest building for at least a few weeks after arrival (Airola). Which could explain the late arrival of the activity in Cavity 2A (Figure xx). The Martins arrived on March 23<sup>rd</sup> and Cavity 2A was not considered active until April 29<sup>th</sup>.

Generally Purple Martins do not hang around an area for any period of time unless it is a nesting site (Airola). The highest count of Purple Martins seen at one time was 12, so even though I was only able to confirm nesting in four cavities which is a total of eight individuals it is possible that there were other nests that were not detected. Most often the birds that are not being seen are on eggs (Airola).

The Purple Martins' peak breeding season is mid-April to July (Airola, 2007). From the end of nest building incubation is 15-18 days, brood rearing to fledging is 28 days and return to the nest for night roosting is 5 to 14 days (Airola). Purple Martins are largely single brooders (only lay a single clutch per season). It is extremely rare to observe a double brood in Purple Martins (Wiggins, 2005). Purple Martins generally fledge early to late June (Airola). Based on the time line Martins were expected fledge by the day of the last observations. However there were no observations of brooding, Hypothesis 4 or fledges, Hypothesis 5.

It is possible that nest building in San Luis Obispo County takes longer than expected. The Purple Martins that nest in San Luis Obispo County are unique in that they nest in the natural cavities of Western Sycamores and therefore nesting at these sites could take longer than what is observed at other sites and what is expected.

Nest sites are pretty quiet during the incubation period, as females are on the nest much of the time and males do not hang around the nest site as much, so as not to draw attention to the

nest (Airola). Beginning May 29<sup>th</sup> the total number of individual Purple Martins seen at the site at one time significantly decreased. From consistently seeing eight to ten each visit it went to seeing only three or one, and the observations were of only male Martins.

Purple Martins could have finished nest building and were incubating eggs when observations ended. There were no observations of Martins carrying nesting material or defending cavities near the end of observations. The only activity seen were males entering and exiting cavities. Observations may have ended right before the brooding and rearing fledgling's timeline began. I am confident that fledglings were not seen at the expected time of mid June, due to Martins taking longer to nest and incubation not beginning until late May. Therefore, the fourth and fifth hypothesis could not be tested. .

Once hatching occurs, it's expected to see an increase in the amount and daily duration of activity, with peak feeding occurring at least 10 times per hour for most of the day (Airola). In addition, when Martins are feeding young birds they are present at the nest site throughout the day (Airola). When I ended observations there was little activity at any of the active cavities. There was a decrease in the observations of cavity use and even a decrease in the number of Martins seen. No observations were made of a food carry by either a male or female. Therefore I am confident that no nest had hatched when I ended my observation on June 15<sup>th</sup>. It can not be said whether it was no nests would hatch or that the nests had not hatched yet.

For my final hypothesis, testing for reproductive success in Purple Martins I expected to see fledglings, young begging outside the cavity and hopefully not see dead young beneath the nest holes. Dead young do not confirm successful fledging but confirm successful brooding. Parents continue to feed fledged juveniles for at least four or five days after fledging (Wiggins, 2005). Therefore, young begging outside the nest would have been an accurate behavior to

determine Purple Martins success. However, no observations were made to confirm the fourth alternative hypothesis and therefore the final hypothesis could not be tested.

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#### Personal Interviews

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