Tracking Purple Martins from South Dakota with Geolocator Devices

By Dennis J. Mammenga and Paul W. Mammenga
2011 - 2012

The purpose of this report is to document the methods, results, and benefits gained and accomplished as described in the South Dakota Game, Fish & Parks Wildlife Division Small Grants Program application (See appendix 1). This project was selected and approved for funding by the Wildlife Division staff and the Small Grants Program in March of 2011.

Objectives

1. Establish a unique collaborating partnership with the Purple Martin Conservation Association (PMCA), York University, South Dakota Game, Fish & Parks (SDGFP), and Purple Martin "landlords".

2. Contribute to and expand knowledge on Purple Martin migration from the western edge of their breeding range in North America, especially South Dakota, to their wintering range in South America.

3. Expand on and/or identify any critical habitats along migratory pathways (e.g. roosts) for Purple Martins from South Dakota and in their wintering range.

4. Build on a foundation of knowledge and understanding of Purple Martin conservation to share among South Dakota citizens, active Purple Martin "landlords", and prospective "landlord" enthusiasts.

Introduction

We have been active landlords hosting Purple Martin (*Progne subis*) nesting pairs at our colony sites for approximately 10 years. We have developed a strong interest in having them be successful in nesting and raising young from our home-yard sites. To be successful with Purple

Martins we needed to understand them better and to gain more knowledge on all aspects of martin biology. Therefore, we joined the PMCA. With our membership we receive a publication (*Purple Martin Update* magazine) four times a year which is full of valuable news and information on Purple Martins.

Our interest in Purple Martins, especially from our colony sites here in South Dakota, grew exponentially upon reading about groundbreaking, first-ever news on "Tracking Purple Martin Migration to Brazil and back" by Dr. Bridget J. Stutchbury in the 2009 Spring issue 18(2) of the *Purple Martin Update* with light collectors called geolocators. We thought this would be fantastic to see if Purple Martins from South Dakota migrate in the same fashion.

This ground-breaking news of tracking two Purple Martin migrations using these innovative devices was first reported on February 13 in professional journal *Science* (Stutchbury et al. 2009) and with a press release by the National Geographic Society which funded part of this new research technology. These two Purple Martins, along with 18 other Purple Martins were fitted with tiny geolocators onto their backs like "backpacks" from the PMCA's Edinboro, PA research colony in 2007. There is much information known about Purple Martin's breeding range in North America and their wintering range in South America, but virtually nothing is known about their migration between each end of this journey. Until now, there was no mechanism to track individual songbirds like Purple Martins, but Dr. Stutchbury at York University and PMCA revealed new migration maps detailing their individual migration pathways, resting locations, and duration for these two Purple Martins in the above publication.

These maps detailed the entire 8,000 mile round trip from PA to Brazil and back, including a trek of 500 miles over the Gulf of Mexico. These tiny geolocators detect light levels and store this data for each day versus transmitters used on larger species of birds send out signals to be received. These new devices need to be retrieved again the following year to download the light data into a computer to be analyzed which means recapturing the returning Purple Martins. Contrary to former beliefs that songbirds take a more leisurely pace to their wintering areas and back was astoundingly much faster, especially on the return trip in

the spring to their breeding areas in as little as only two weeks after leaving wintering sites (Stutchbury, B. 2009).

After capturing these two Purple Martins with geolocators in spring of 2008, York University and PMCA were interested in learning more and to develop a smaller device in hopes of improving returning rates for the martins. So, in summer of 2008 another 20 new devices were deployed from PA. When spring of 2009 came, only 3 Purple Martins returned still leaving concerns from PMCA and York University staff of lower than expected returns, but the information being gathered from these geolocators was outstanding.

After reading this new founded information on Purple Martins, we were now excited to be a part of this new science, especially Paul. He read in this same *Purple Martin Update* issue a small side bar column to sponsor a Purple Martin with a geolocator because PMCA was seeking more funding to deploy even more geolocators in 2009, not only in PA but possibly in Texas. So, Paul decided to sponsor one geolocator for $200. In addition to his donation, he included a letter explaining his interest in this technology, bird handling, and banding experiences to express his willingness to participate in future research with geolocators here in South Dakota. Paul received a thank you for the money and a positive letter response from Mr. John Tautin from PMCA expressing an interest in discussing any future collaboration with this study. In the letter Mr. Tautin mentioned South Dakota being on the western edge of the martin's breeding range would be an interesting place to go if there are any possibilities for expansion in 2010.

This letter with a positive reply gave us some hope and excitement that this type of research using geolocators could possibly be used in South Dakota. Upon reading in a preceding issue of *Purple Martin Update* that funding after 2009 would become more difficult to possibly continue any expansion of additional geolocator research, especially if the rate for the new designed devices does not improve. Paul communicated further with Mr. Tautin on research continuing in 2010. Mr. Tautin expressed the great funding efforts to deploy 41 geolocators in 2009 with 20 being deployed in Texas and 21 in PA of which one was sponsored by Paul. PMCA wanted to wait and see how things shaped up with the return rates on these new devices before any future commitments and plans are made. These new geolocator devices were more streamlined with smaller units

and with much shorter light sensor stalks (Tautin 2009). PMCA was optimistic that these changes will help show positive application results and they would be willing to advise and assist others on any independent geolocator studies in 2011, like in the state of South Dakota, after seeing the returns in 2010.

Finally, the 2010 Purple Martin breeding season arrived in TX and PA and folks at PMCA were ecstatic with the recovery of 9 geolocators from the 20 deployed in TX and 11 from the 21 deployed in PA (Tautin and Barrow 2010). The excitement built for Paul also, because he was informed that the first Purple Martin with a geolocator to be captured and retrieved in 2010 in PA was the martin he sponsored. He received a certificate of appreciation and a map revealing the migration travels for this martin.

This new style geolocator used in 2009 proved to be a valuable device for this type of research resulting now in a recovery rate close to 50% (20 out of 41) on returning Purple Martins with geolocators in 2010 (Tautin and Barrow 2010). With this renewed confidence in the effectiveness of geolocators, PMCA and York University decided to continue with plans in 2010 with deployment of 41 more geolocators with 11 more going to TX and 20 more to PA. PMCA also decided to collaborate with individuals in Virginia in 2010.

With continued success with this newer style geolocator, plans were to continue with projects in PA and VA and collaborate with two new independent projects in New Jersey and Minnesota for 2011. We were contacted to see if South Dakota still had an interest in collaborating with a geolocator project in 2011. PMCA and York University were very willing to form a partnership to assist with coordinating the order for geolocators, program the geolocators, and train individuals in fitting geolocators on Purple Martins along with any other logistic details. We just needed to have someone to direct the individual state's efforts, and to come up with financial support to fund the cost of the geolocators and other project expenses. Thus, this first-ever type research project on Purple Martins from South Dakota.

Study Area

Two breeding colony sites in eastern SD were selected for this project. The first colony site is located in Minnehaha County at 8108 W. 42nd St, Sioux Falls, on the western edge of the city at Dennis Mammenga residence. This site in 2011 consisted of 6 different systems with 140 compartments available for Purple Martins to claim and nest in. There were approximately 100 to 120 nesting pairs with most pairs being ASY (After Second Year) adult martins.

Dennis with some of his front yard systems at Sioux Falls colony site.

The second colony site is located in Brown County at 12345 396th Ave, Columbia, south of town at Paul Mammenga residence. This site has been an active breeding colony for 12 years. This site in 2011 consisted of three systems with a total of 66 compartments available for Purple Martins to claim and nest in. There were 56 nesting pairs with most pairs being ASY adult martins.

Paul's backyard systems at Columbia colony site.

Methods

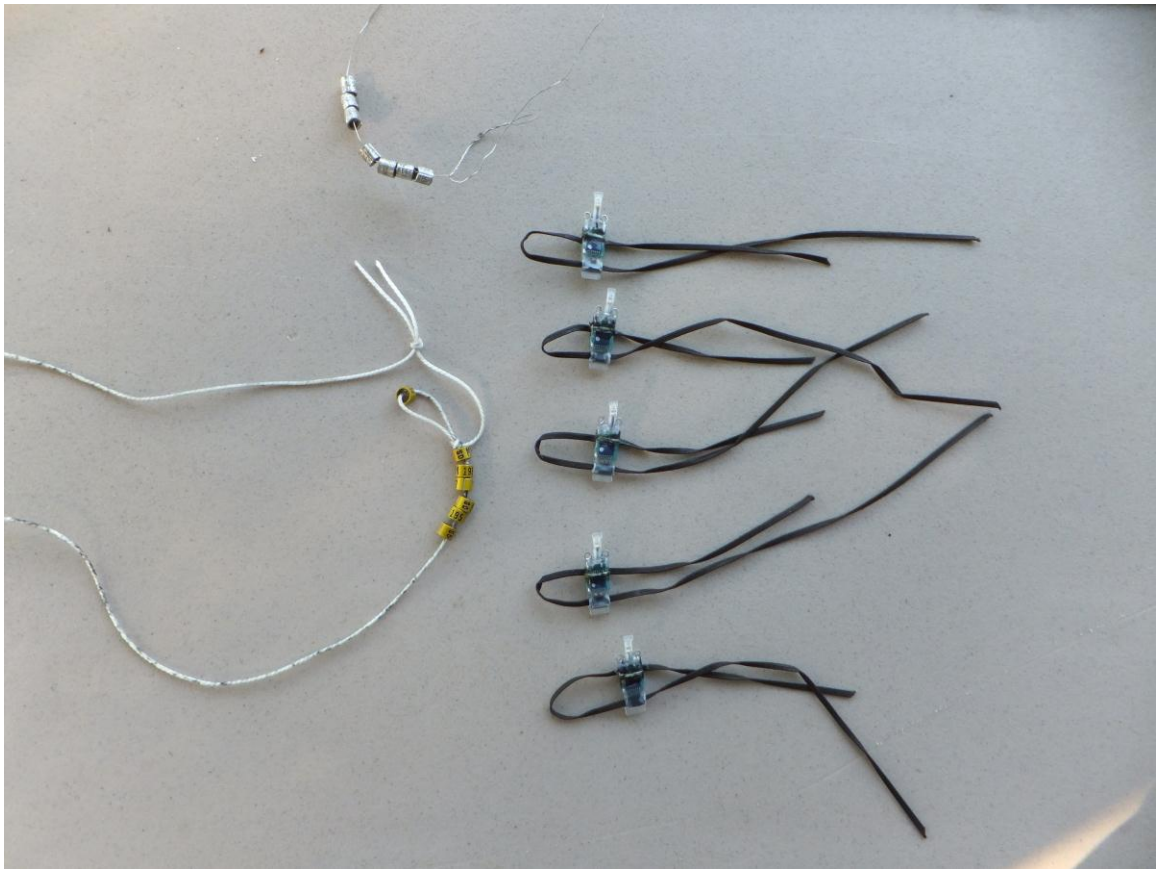
As noted in the introduction, initial dialog was developed on the serious willingness to collaborate with PMCA and to direct our own independent project with geolocators on Purple Martins from SD. Contacts and communications were conducted and maintained throughout this project by emails and telephone calls to collaborate a workable partnership with PMCA, York University, and SDGFP Wildlife Diversity.

With funding now awarded through the small grant contract, collaboration was accomplished with PMCA to coordinate a purchase order to include 27 geolocators for a cost of $150 each with payment of $4,050 to PMCA on 21 June 2011. We coordinated with SDGFP Wildlife Diversity to release $4,000 of the total contract of $5,000 to cover the majority of the geolocator

costs. All other costs for project needs were from our own out-of-pocket expenses.

Geolocator Deployment

From past (2007-2010) research on "Geolocator Designs and Return Rates of Purple Martins", Dr. Bridget J. Stutchbury, Dept. of Biology, York University, Toronto ON recommends for future deployments to use 0.10 inch Teflon ribbon harness to prevent injury and tag loss, and 1.1 g MK10S geolocators with a light sensor stalk length of 5-8 mm set at a 15 degree angle to minimize drag during flight.



Geolocators with Teflon harness ready to go along with leg bands.

The geolocators used for this project were developed by British Antarctic Survey in coordination with York University. The model was MK10S that weighed 1.2g with a 9mm light sensor stalk set at a 15 degree angle fitted with 0.10 inch Teflon ribbon harness. All calibrations for the geolocators were accomplished by York University. Training on proper technique for attaching geolocator devices with Teflon harness was conducted with Kevin

Fraser from York University at the time of deployment at the Sioux Falls colony site and at the Columbia colony site.

Kevin training Paul on proper technique on attaching a geolocator.

To coordinate and collaborate with York University on proper timing for deployment of geolocators on Purple Martins from South Dakota and Minnesota during the same trip for Kevin, extensive monitoring of nesting behavior, egg laying, and hatching dates with projected dates of the young reaching 10 – 15 days of age was accomplished. This monitoring of nest checks occurred every 5-7 days at the Columbia colony site. From this effort of knowing the actual age of the young, a time-table was developed to have Kevin make arrangement to fly to Minneapolis from Toronto, ON arriving on 24 June. Plans were that we would travel to Minneapolis to pick Kevin up at the airport and drive back to accomplish deployment efforts in South Dakota first on 25 June at the Sioux Falls colony site and at the Columbia colony site on 26 June. After work was accomplished in South Dakota, the next day, 27 June, we drove Kevin to the first deployment site in Willmar, MN.

Capturing

Monitoring nesting season by doing nest checks was necessary and helpful to identify individual Purple Martins for capture and to know the proper timing for deployment resulting in the highest probability of success and survival of individual martins both young and adults involved. The target Purple Martins for deployment with geolocators were ASY (adults) with as close to a 50/50 ratio of males to females. The number of geolocators deployed at each study site would be 13 at the Sioux Falls colony site and 14 at the Columbia colony site.

Since both colony sites consisted of nesting compartments in both natural gourds and wood houses, modifications to them needed to be made to facilitate capturing efforts during deployment.

Natural gourd prepared for tunnel entrance modification.

At each colony site, 24 nesting gourds were fitted and modified with tunnel entrances that would support a trap door mechanism.

Gourds modified with tunnel entrances to support trap doors.

Trapping mechanisms to support trap doors were installed on 7 wood house compartment entrance holes at each colony site also.

Entrance holes with small rods along the sides to support a trap door, like in lower right.

These modifications were accomplished in April, prior to adults returned, to allow acceptance and favorable adjustments to these entrance hole modifications. Most all of the modified entrance holes on the nesting compartments were claimed by adult Purple Martins with nest building occurred during the first couple weeks of May 2011.

To operate trap door mechanisms, six small diameter metal rods six inches long with at least 50 feet of string attached were used as a “fishing” tactic. When the string is pulled, the trap door would fall down covering the entrance hole once the target Purple Martin entered the compartment to feed the young inside. This capture technique (Tautin and Barrow 2010) was the only technique used initially for capturing Purple Martins to deploy geolocators at both colony sites in SD.

Our Dad using the “fishing” tactic for capturing martins.

The presence of the string attached to the pull rods above each entrance hole were detected by the Purple Martins, but acceptance and any danger was overcome because of the stronger instinct (parenting) to feed their young.

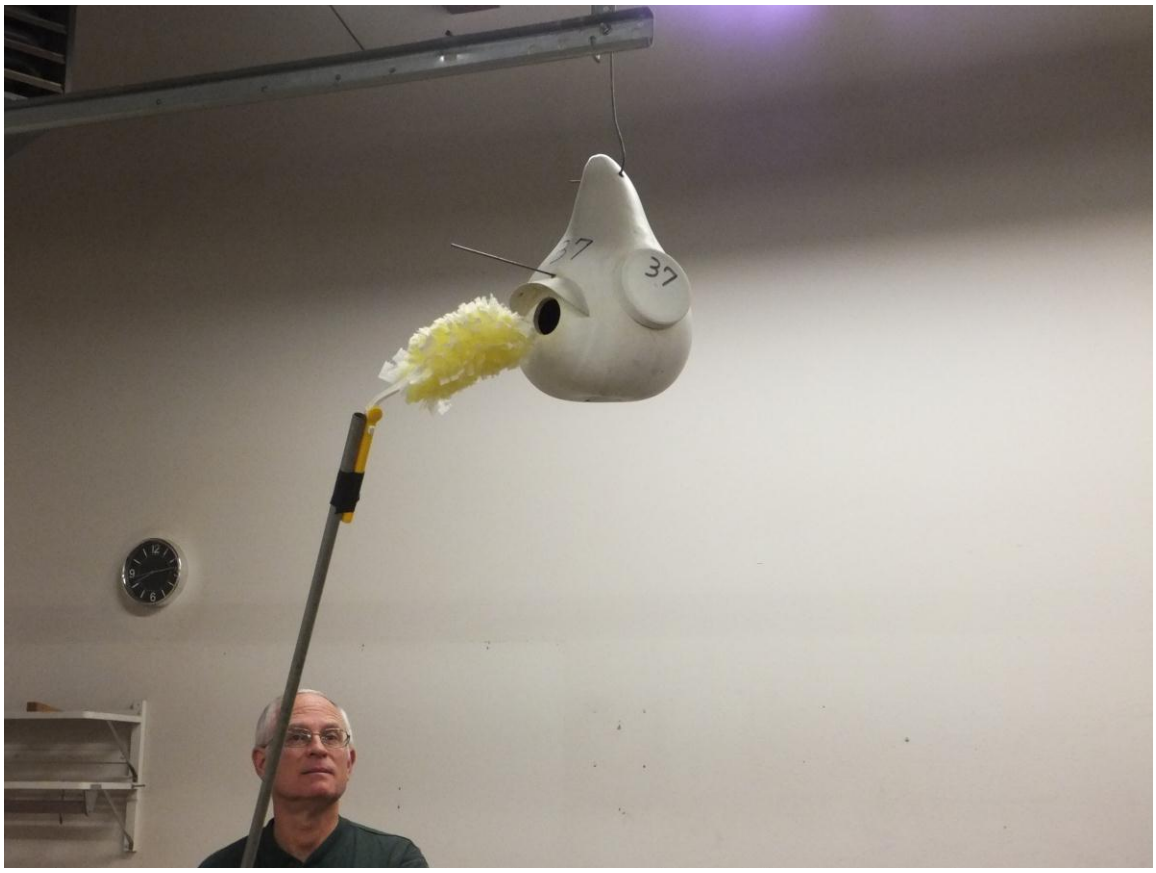
The team effort needed at the time of capture and deployment was at least two people to capture (“fishing”), two people to hold the martin while the other attached the geolocator device to the back of each martin, and one person responsible for recording data collected.

Team effort of "fishing" (capturing) target martins from multiple compartments.

Kevin and Paul attaching geolocator while Joy records the data.

Another capturing technique as described by John Tautin (2008), and Nanette Mickle and John Barrow (2011) called “Martin Mornings” is where the entrance holes to a number of compartments would be plugged in the darkness of very early morning with adults still in their nest compartment was investigated. We did not favor or used this option to capture martins. We investigated another capture technique described by Tautin and Barrow (2010) was the use of a long conduit pole or wooden handle with a plastic cup or sponge taped to one end that would be used to plug the entrance hole quickly when a “target” Purple Martin would go inside their compartment.

We anticipated some of the returning Purple Martins with geolocators in 2012 may not claim nesting gourds again with tunnel trap mechanisms. We did employ a modified version of the “sponge on a pole” capturing concept. We used a ten foot long half inch metal conduit with a “Swiffer duster” attached to one end.



Swiffer duster capturing pole.

The fluffy Swiffer duster end would fit nicely into an entrance hole to keep the target Purple Martin into the nest compartment upon entering. We would be in position to quickly approach the compartment to place the fluffy swiffer end into the hole.

We modified the tunnel trap mechanisms to accommodate the capture of returning Purple Martins with geolocators in the spring of 2012. These returning martins with geolocators were more wary of the “fishing” approach used the previous summer because of the visible string.

The “fishing” approach with visible pull pen and string above entrance hole.

We modified the trap door on the tunnel entrance to a “self” capturing approach where the pull wire with a circle loop would be set up from inside the tunnel entrance hole. We constructed a much finer loop pull wire and painted it black so as not to be as noticeable to the martins upon entering the hole. This round loop would be just a little bit smaller than the round entrance hole and be positioned close to the round entrance hole from the

inside. Upon entering the hole and pushing through the fine wire round loop, the martins would self-pull the wire holding the trap door causing the trap door to fall down covering the hole and capturing the martin inside the gourd.

The “self” trapping approach showing the trap door set and an example of the round wire.

This method worked well but at times required a lot of time and patience in recapturing the same martin again for any planned re-deployments or data sampling.

Sampling

Blood and feather samples were collected following “Field Sampling Protocol 2011” established by Stutchbury Lab. York University. One small blood sample in a capillary tube was collected from each Purple Martin.

Blood sample being taken from underneath the wing.

Three different feather samples were collected from each Purple Martin to cooperate with a molt migration research project at York University. The first feather sample was the P1 primary wing feather number 1(which molts the earliest). The sample was collected by clipping 1cm from the end of the feather. The second sample collected was the R3 tail feather (third from center) which there is 12 tail feathers, 6 on each side of center. This feather was pulled and placed in the same sample envelope as P1. The whole feather is needed to measure growth bars and feather quality. The last feather sample collected was the S6 (secondary wing feather) which molts last, the end 1cm from the tip was clipped and placed into its own sample envelope. Both of these sample envelopes for each Purple Martin were labeled fully with all pertinent information. Again, these samples were not needed for this project, but we cooperated with research being conducted by York University on Purple Martins.

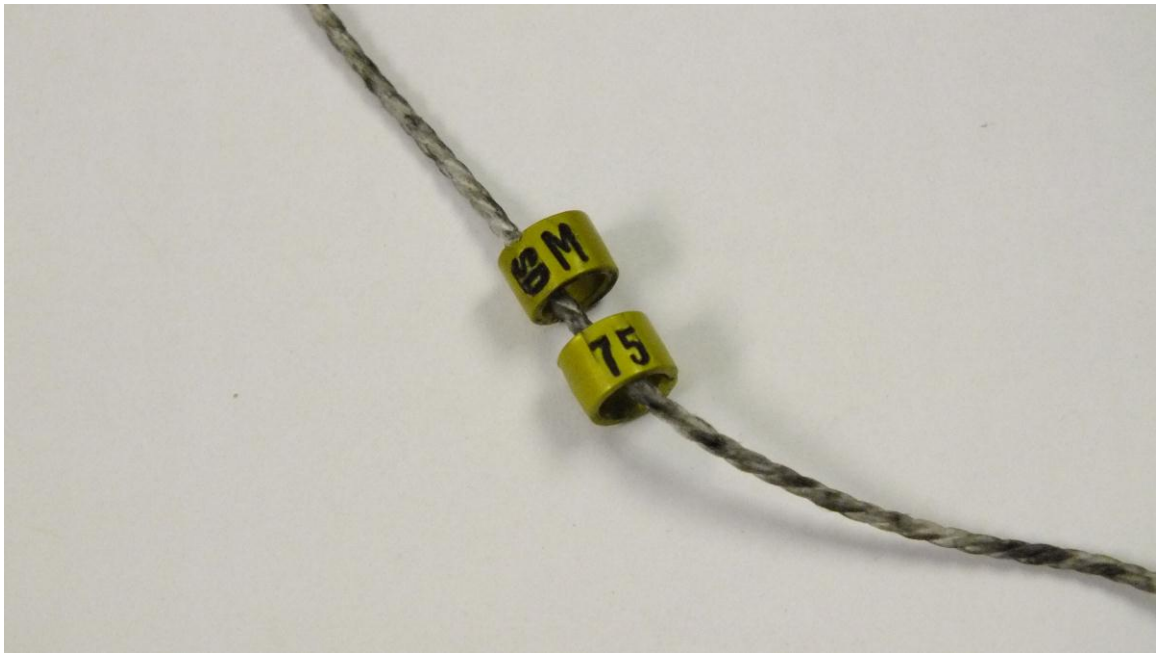
A feather sample being collected and placed into an envelope.

Banding

As individual "hobbyist" Purple Martin landlords, we needed to coordinate the banding and deployment of geolocators with a licensed master permit holder from SDGFP Wildlife Diversity. We coordinated with Eileen Dowd Stukel to be sub permitted under her master permit (# 21966 State of South Dakota – Nongame). Eileen needed to amend this master permit to obtain proper authorization from the Bird Banding Laboratory to band Purple Martins with geolocators and to put on auxiliary color leg bands in addition to the standard federal leg bands. This master permit was also amended with special authorization to trap Purple Martins, to take feather samples, and to take, possess, and transport blood samples not to exceed 1percent body mass.

The following auxiliary marking authorizations listed on the master permit for geolocator devices were: MK10S models with leg loop harness of 0.10 inch Teflon ribbon and light sensor stalk of 5-8mm, and device plus all

attachment materials not to exceed 3 percent total body weight including all bands. The color leg bands will be yellow anodized aluminum with black coding following the marking protocol used by PMCA and other Purple Martin banders. The two letter state abbreviation **SD** (sideways) followed by 1 letter **M** and two digits (**00 – 99**) of parakeet size (9/64 in. I.D) bands will be used by matching the two number digits on the color band to the last two number digits on the 1A size federal aluminum leg bands.



Color bands illustrating coding used: SD M 75.

One hundred yellow color parakeet size bands with coding protocol along with one parakeet plier were purchased for $52.95 from L & M Bird Leg Bands, INC. San Bernardino, CA.

The last permit obtained was a Scientific Collector's Permit from SDGFP License Number 45 for 2011 and License Number 13 for 2012 allowing capture, banding, and collecting activities on Purple Martins in SD during this project.

Results

Sioux Falls Colony Site 2011

The first ASY (adult) Purple Martin returning to this colony site in 2011 was on 3 April. Weather conditions were cold, cloudy, with some rain during the month of April which delayed the nesting activities. Egg laying began on 23 May. Nesting activity was checked on 18 June to access number of nests with eggs and age of any young hatched so far. With young in some nests, we used the Purple Martin Prognosticator on the oldest young to determine the projected date these young would be 15 days of age.

A valuable tool used to determine hatching and fledging dates.

The optimal time to band young in nests are 12 to 20 days old to avoid abandonment and achieve successful fledging (Farrell 2009). We picked the projected date range when many of the adult Purple Martins had young 15 days old in projecting travel scheduling plans for Kevin Fraser to come to

SD and MN in one trip. We determined the optimal time for deployment of geolocators at this colony site would be around 26 June – 6 July. Due to other deployment planning's for Kevin at other colony sites in other states, Kevin decided to come to SD first.

We traveled to the Minneapolis airport to pick Kevin up on 25 June with travel made that day to Sioux Falls. Geolocator deployment day was 26 June.

Kevin Fraser ready to attach the first-ever geolocator in SD.

The number of geolocators scheduled to be deployed at the Sioux Falls colony site was orginally13 devices. Because of planning efforts and nesting activity documentation for each nesting compartment and for which sex for each adult chosen for deployment, the work progressed very well that Kevin through York University donated an additional two more geolocators. These were deployed on SY (sub adults) nesting Purple Martins as per their request to be included in research they were conducting on sub adults.

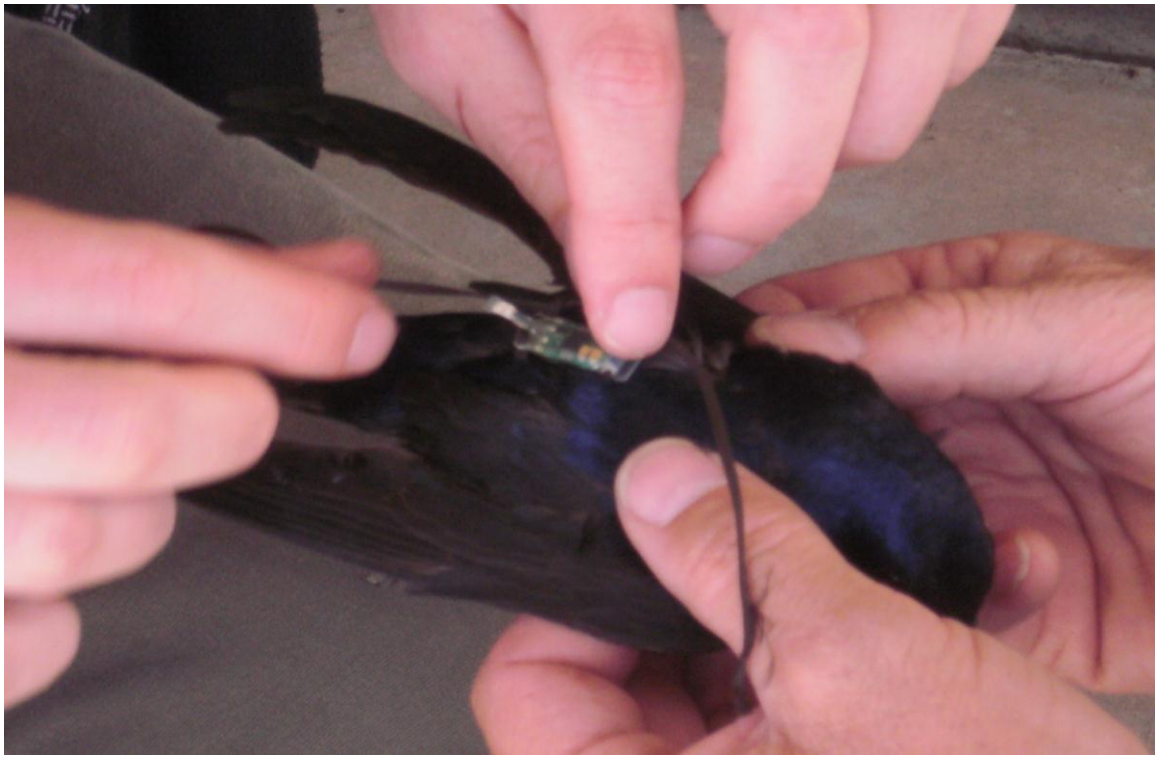
Photo by Kevin Fraser.

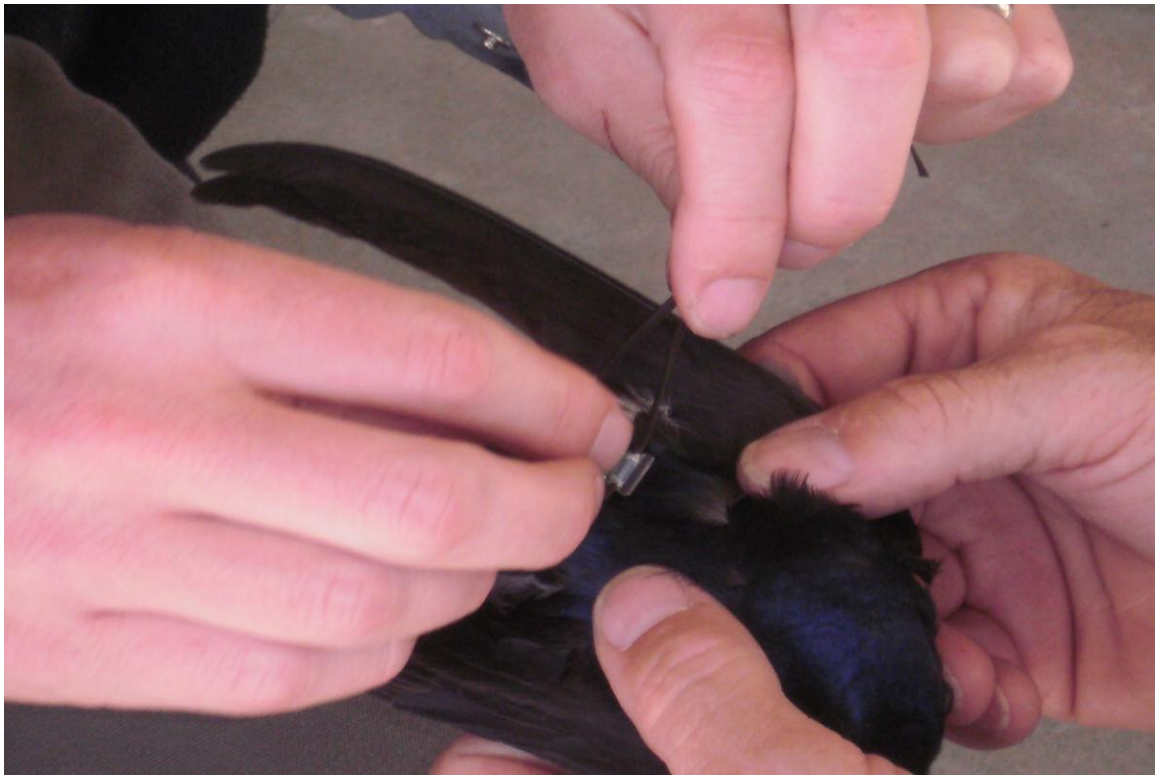
Dennis lowering the system while Paul is getting “fishing” tools ready.

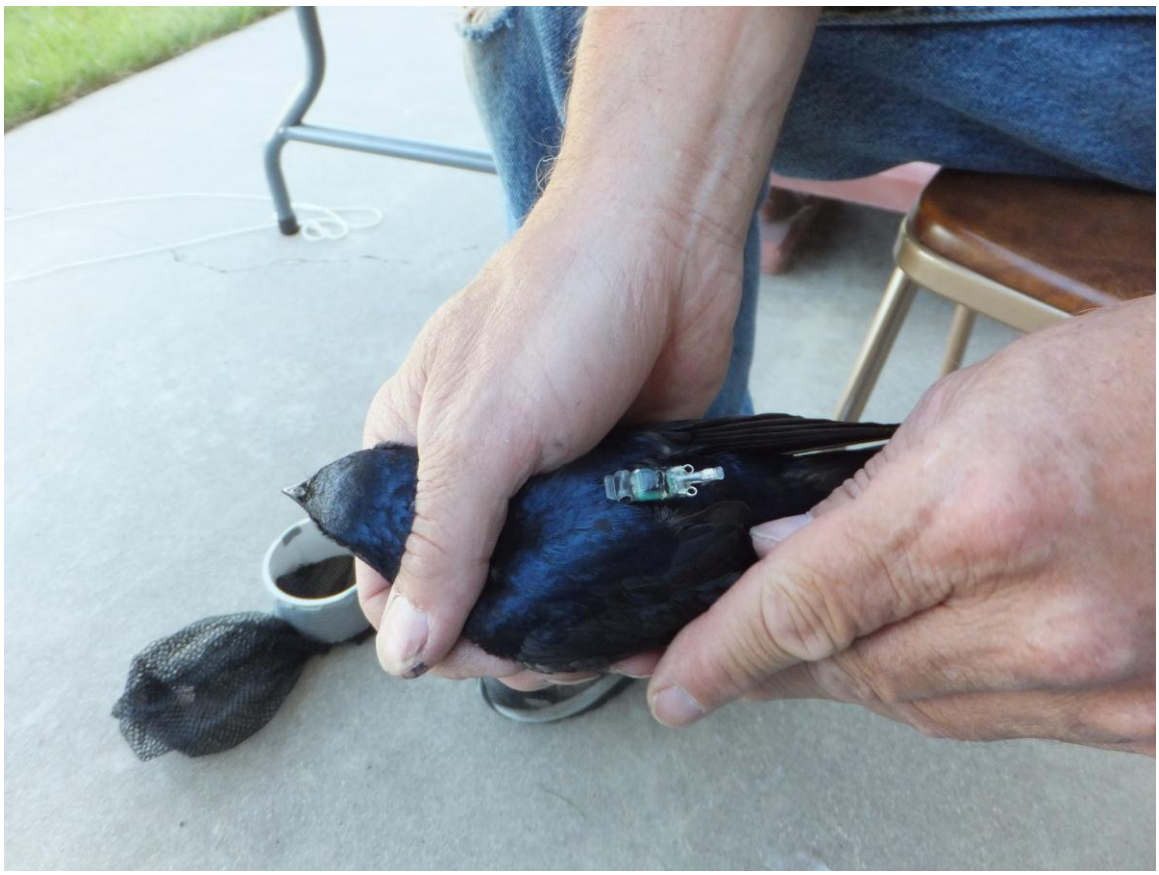
Photo by Kevin Fraser.

Paul setting the trap door for capturing.

The SY martins selected for deployment where a nesting pair from a gourd. There were three adult pairs selected from the gourds also while only 2 (a pair) martins were selected from a wooden house compartment. The remaining ones captured for deployment were singular adults from nesting pairs.


Positioning geolocator onto the back of a Purple Martin.


Tying on the geolocator.


Geolocator attached.

A total of 15 geolocators were deployed at the Sioux Falls colony site on 26 June 2011, of which 13 were ASY and 2 were SY Purple Martins. For the SY martins a male and a female were selected while for the ASY martins 7 males and 6 females were selected for deployment.

The additional tasks of banding with color leg bands, normal federal bands, and collecting of blood and feather samples from each individual Purple Martin was successfully accomplished at the time of geolocator attachment.

All of the Purple Martins deployed with geolocators successfully completed nesting and fledging activities by the end of August. Now the long wait is on for the return of Purple Martins with geolocators in 2012.

Dennis ready to release a geolocator Purple Martin.

Dennis deploying a geolocator Purple Martin.

Columbia Colony Site 2011

The first ASY Purple Martin returning to this colony site in 2011 was 22 April. Weather conditions were similar as those experienced at the Sioux Falls colony site, but were much shorter in duration and did not influence nesting activities. Egg laying began on 24 May. Nest checking and monitoring was initiated on 26 May. Nest checks were conducted approximately every 5 days until all young were fledged. Using the Purple Martin Prognosticator, the projected optimal date range determined at this colony site was 28 June – 8 July for potential geolocator deployments. This range was very similar to the Sioux Falls colony site. Therefore, we were ready for deployment of geolocators in SD.

Geolocator deployment day was on 27 June at this colony site the day after deployment at Sioux Falls colony site.

Kevin and Paul collecting data from the first Purple Martin captured at Columbia site.

Paul lowering system and Dan Nelson getting ready to retrieve another captured martin.

Kevin retrieving captured martin through access door of a gourd.

Kevin placing captured martin into mesh bag with proper labeling before bring to the work table.

Making sure the geolocator harness is around the legs properly.

The number of geolocators scheduled to be deployed at this colony site was 14. Again with the organized efforts of documenting nesting activity and knowing which individual Purple Martin was to be captured proved beneficial as York University donated 4 more geolocators to be used at this colony site on SY nesting martins.

Paul with Purple Martin with geolocator attached ready to be deployed.

None of these selected Purple Martins at this site were paired. Most of the martins captured came from nesting gourds while only 4 were captured from nesting compartments in the wooden house.

A total of 18 geolocators were deployed at this colony site on 27 June 2011, of which 14 were ASY and 4 were SY martins. For the SY Purple Martins deployed, one was a male and 3 were females. As for the ASY martins deployed, 7 were males and 7 were females.

The additional task of banding and collecting of blood and feather samples from each individual Purple Martin was successfully accomplished at the time of geolocator attachment. All of the Purple Martins deployed with geolocators successfully completed nesting and fledging activities by the end of August.

Geolocator attached to the back of an ASY male Purple Martin.

Overall, a total of 33 geolocators were deployed for the first time-ever on Purple Martins from South Dakota, with 15 deployed at the Sioux Falls colony site and 18 deployed at the Columbia colony site. Of this total number deployed, 16 were males and 17 were females.

Paul deploying a Purple Martin with a geolocator while Chris Hull watching.

Now the long wait begins for the return of any Purple Martin with a geolocator in 2012.

Sioux Falls Colony Site 2012

The excitement level greatly increased in anticipation of returning Purple Martins with geolocators with the first sighting of an ASY martin at this colony on 1 April. Weather conditions during April were very favorable for returning Purple Martins. The numbers returning grew at a fast pace

compared to 2011 making observations more difficult for locating martins with geolocators. We decided to combine efforts on 12 May to locate any Purple Martins with geolocators. During the early morning when the martins are active yet around the colony site and before venturing out to feed, we located three martins (2 females/1male) with geolocators. Two were in the backyard gourd system and one in the front yard gourd system. All three returning Purple Martins with geolocators settled into different systems this year than from the systems they were captured from in 2011.

All three were "settled" (claiming) into gourds that did not have any modified tunnel entrance holes to support a trap door. We decided on using a modified proto-type of the sponge or cup taped to the end of a long pole used by others described in the Methods Section. We taped a swiffer duster onto the end of a ten foot conduit pole. The swiffer duster could be positioned at a 45 degree angle so that the fluffy end would fit into the 2 inch round entrance hole easily keeping the "target" martin trapped inside while another person would lower the system down for retrieval.

Early in the morning on 13 May, we attempted to capture the two martins from the backyard system with the female the first target. Using the "swiffer pole", we were successful on capturing this ASY female (band number 2331-84507) from gourd number 84. The next martin targeted was the male from the same system. It took about another hour to finally capture this ASY male (band number 2331-84506) from gourd number 159. Our attention then turned to the third martin (ASY female) claiming gourd number 50 in the front yard system. She proved to be very cautious on going into her gourd with us positioned nearby. After spending the remaining morning waiting until her activity around the gourd was reduced because of feeding activity, we decided to wait until the next weekend to try again. Hopefully, her activity of claiming her gourd would be stronger.

We gathered again on 19 May in the early morning before the Purple Martins were coming out of their compartments. It was a cloudy morning with light sprinkles of rain beginning. We decided to take a chance to go plug this female's entrance hole hoping she was still inside and before she knew we were hanging around again. The rack system was purposely kept lower so as to reach the entrance hole with the "swiffer pole" right away. It worked! She (band number 2331-84511) was still inside. We were excited because we now had our third geolocator retrieved from this colony site. Efforts continued that day and the next to locate any more returning martins

with geolocators not only at this colony site, but at three neighboring colony sites also. No more Purple Martins with geolocators could be located from deployments at this site.

Data from Geolocators

These three geolocators were packaged up and shipped to Dr. Stutchbury at PMCA office in PA where she downloaded the data from each geolocator to produce the migration maps (both Fall and Spring) for each band number for each individual Purple Martin.

2331-84507

The migration map will show the pathway (Fall-Red/Spring-Black) and duration (Dates) of stops made for this ASY female captured from gourd number 84. Her migration map will be identified with this band number. She was captured and geolocator removed on 13 May 2012.

FALL MIGRATION 2011

This female was successful in her nesting activities and left the colony site on 21 August with the first night on Fall migration on 22 August (see map for 2331-84507). The second night she was already on the Gulf coast (only two days to reach the Gulf coast from Sioux Falls) and stayed another night before heading along the western edge of the Gulf reaching the Yucatan peninsula in about one week (29 Aug). Her migration slowed down going through Central America until reaching the wintering grounds in Brazil on 4 October. She spent most of the time in the same general area of the wintering grounds until she left on 21 April 2012.

This fall migration total trip distance from the colony to the wintering grounds was 4,645 miles (Table 1). Total duration of her fall migration from the colony to the wintering grounds took 44 days with an average overall fall migration rate of 106 miles/day.

Map for band number **2331-84507**

Table 1. Fall Migration from colony or distinct roost - 2011.

Breeding Colony	Band No.	Year Deployed	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Fall Migration (from Colony or Roost)	Wintering Ground Arrival Date	Fall Migration Total Distance (from colony or distinct fall roost) (miles)	Fall Migration Total Duration (from colony or distinct fall roost) (days)	Fall Migration Overall Rate (from colony or distinct fall roost) (m/d)
SD-SF	233184506	2011	M	2	19-Aug	15-Sep	4580	27	170
SD-SF	223184507	2011	F	2	22-Aug	04-Oct	4645	44	106
SD-SF	233184511	2011	F	2	20-Aug	18-Sep	4303	31	139
SD-C	233184518	2011	F	2	21-Aug	28-Sep	4548	39	117
SD-C	233184523	2011	M	2	21-Aug	29-Sep	5408	40	135
SD-C	233184528	2011	M	2	14-Aug	19-Sep	3829	37	103
SD-C	233184529	2011	M	2	03-Sep	23-Oct	5179	51	101
SD-C	233184530	2011	M	2	02-Sep	05-Oct	4924	34	145
SD-C	223184531	2011	M	1	03-Sep	02-Oct	5371	30	179

SPRING MIGRATION 2012

Her spring migration followed closely the same pathway through Central America as during fall migration. She left Central America on 2 May and crossed the west side of the Gulf reaching the Texas coastline on 3 May. Then only taking three more days arriving back at the colony site on 6 May (see map for 2331-84507). Remember that we retrieved the geolocator from her on 13 May.

This spring migration total trip distance from the last wintering grounds roost back to the colony site was 4,450 miles (Table 2). Total duration of her spring migration back to the colony site was 15 days with an average overall spring migration rate of 296 miles/day. Her total migration distance from the colony site to the wintering grounds and back to the colony site from the last wintering ground roost was 9,095 miles

Table 2. Spring Migration from last winter roost - 2012.

Breeding Colony	Band No.	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Spring Migration (from last winter roost)	Arrival Date at Breeding Site	Spring Migration Total Distance (from last winter roost) (miles)	Spring Migration Total Duration (from last winter roost) (days)	Spring Migration Overall Rate (from last winter roost) (m/d)	Total Annual Migration Distance (miles) fall to first roost, spring from last roost
SD-SF	233184506	M	2	25-Mar	21-Apr	5265	28	188	9845
SD-SF	223184507	F	2	22-Apr	06-May	4450	15	296	9095
SD-SF	233184511	F	2	06-Apr	19-Apr	4633	14	331	8936
SD-C	233184518	F	2	07-Apr	27-Apr	4290	21	204	8838
SD-C	233184523	M	2	08-Apr	28-Apr	4964	21	236	10372
SD-C	233184528	M	2	18-Apr	01-May	4393	14	314	8222
SD-C	233184529	M	2	01-May	21-May	4697	21	224	9876
SD-C	233184530	M	2	12-Apr	04-May	5341	23	232	10265
SD-C	223184531	M	1	11-Apr	02-May	5180	22	235	10551

2331-84506

The ASY male Purple Martin captured from gourd number 159 in the backyard system is identified with this band number on the migration map. He was captured and geolocator removed on 13 May.

FALL MIGRATION 2011

This martin with his mate were successful in nesting activities and he left the colony site on 19 August (see map for 2331-84506). He spent 4 days (21-25 August) probably at a roost on the Iowa-Missouri state line before making a two day trip to the southern tip of Texas along the Gulf coast on 27 August. He then took three days across the western edge of the Gulf to reach the Yucatan peninsula. He then spent a week in this region before traveling through Central America and finally reaching the wintering grounds of the Amazon on 15 September.

Map for band number **2331-84506**

This martin stayed in this general area of the rainforest until 7 January 2012 when he moved east closer to the mouth of the Amazon River and stayed in this winter ground area until 24 March.

Table 1. Fall Migration from colony or distinct roost - 2011.

Breeding Colony	Band No.	Year Deployed	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Fall Migration (from Colony or Roost)	Wintering Ground Arrival Date	Fall Migration Total Distance (from colony or distinct fall roost) (miles)	Fall Migration Total Duration (from colony or distinct fall roost) (days)	Fall Migration Overall Rate (from colony or distinct fall roost) (m/d)
SD-SF	233184506	2011	M	2	19-Aug	15-Sep	4580	27	170
SD-SF	223184507	2011	F	2	22-Aug	04-Oct	4645	44	106
SD-SF	233184511	2011	F	2	20-Aug	18-Sep	4303	31	139
SD-C	233184518	2011	F	2	21-Aug	28-Sep	4548	39	117
SD-C	233184523	2011	M	2	21-Aug	29-Sep	5408	40	135
SD-C	233184528	2011	M	2	14-Aug	19-Sep	3829	37	103
SD-C	233184529	2011	M	2	03-Sep	23-Oct	5179	51	101
SD-C	233184530	2011	M	2	02-Sep	05-Oct	4924	34	145
SD-C	223184531	2011	M	1	03-Sep	02-Oct	5371	30	179

This fall migration total trip distance from the colony to the first wintering ground roost was 4,580 miles (Table 1). Total duration of his fall migration to the wintering grounds was a “speedy” 27 days with an average overall fall migration rate of 170 miles/day.

SPRING MIGRATION 2012

First night on spring migration was 25 March. Spring migration through Central America followed closely the same pathway as on the fall migration. This martin left Central America on 13 April crossing the western side of the Gulf reaching the Texas gulf coast on 17 April. He then took only three more days to arrive back at the colony site on 21 April. This spring migration total trip distance from the last wintering ground roost back to the colony site was 5,265 miles (Table 2).

Table 2. Spring Migration from last winter roost - 2012.

Breeding Colony	Band No.	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Spring Migration (from last winter roost)	Arrival Date at Breeding Site	Spring Migration Total Distance (from last winter roost) (miles)	Spring Migration Total Duration (from last winter roost) (days)	Spring Migration Overall Rate (from last winter roost) (m/d)	Total Annual Migration Distance (miles) fall to first roost, spring from last roost
SD-SF	233184506	M	2	25-Mar	21-Apr	5265	28	188	9845
SD-SF	223184507	F	2	22-Apr	06-May	4450	15	296	9095
SD-SF	233184511	F	2	06-Apr	19-Apr	4633	14	331	8936
SD-C	233184518	F	2	07-Apr	27-Apr	4290	21	204	8838
SD-C	233184523	M	2	08-Apr	28-Apr	4964	21	236	10372
SD-C	233184528	M	2	18-Apr	01-May	4393	14	314	8222
SD-C	233184529	M	2	01-May	21-May	4697	21	224	9876
SD-C	233184530	M	2	12-Apr	04-May	5341	23	232	10265
SD-C	223184531	M	1	11-Apr	02-May	5180	22	235	10551

Total duration of his spring migration from the last winter roost back to the colony site was 28 days with an average overall spring migration rate of 188 miles/day. His total migration distance from the colony site to the wintering grounds and back to the colony site in the spring was 9,845 miles. We retrieved this geolocator from him on 13 May 2012.

2331-84511

This ASY female was captured from gourd number 50 in the front yard system and was difficult to capture during the first attempt on 13 May, but was captured and geolocator remove from her on 19 May 2012.

FALL MIGRATION 2011

This martin and her mate were successful in nesting activities and she left the colony site on 31 July (see map for 2331-84511) to a pre-migratory roost site on the Nebraska – Iowa border. Very possible this is the documented pre-migratory roost in Omaha, NE.

Map for band number **2331-84511**

She arrived at this roost on 1 August and stayed at this location for 18 to 19 days with her first night on fall migration from this roost on 20 August 2011 (Table 1). Her fall migration pathway ventured a little further east through central Missouri, Arkansas, and Louisiana with arrival to the LA coast on 23 August. She then followed the coast line west along Texas to the southern tip of Texas before crossing the Gulf and reaching the southern area of the Yucatan on 29 August. She spent approximately 10 days in Central America before heading to and arriving to the first wintering ground roost on 18 September. She spent time on and at five different wintering ground roosts (see map for 2331-84511) before heading on spring migration 5 April 2012.

Table 1. Fall Migration from colony or distinct roost - 2011.

Breeding Colony	Band No.	Year Deployed	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Fall Migration (from Colony or Roost)	Wintering Ground Arrival Date	Fall Migration Total Distance (from colony or distinct fall roost) (miles)	Fall Migration Total Duration (from colony or distinct fall roost) (days)	Fall Migration Overall Rate (from colony or distinct fall roost) (m/d)
SD-SF	233184506	2011	M	2	19-Aug	15-Sep	4580	27	170
SD-SF	223184507	2011	F	2	22-Aug	04-Oct	4645	44	106
SD-SF	233184511	2011	F	2	20-Aug	18-Sep	4303	31	139
SD-C	233184518	2011	F	2	21-Aug	28-Sep	4548	39	117
SD-C	233184523	2011	M	2	21-Aug	29-Sep	5408	40	135
SD-C	233184528	2011	M	2	14-Aug	19-Sep	3829	37	103
SD-C	233184529	2011	M	2	03-Sep	23-Oct	5179	51	101
SD-C	233184530	2011	M	2	02-Sep	05-Oct	4924	34	145
SD-C	223184531	2011	M	1	03-Sep	02-Oct	5371	30	179

This fall migration total trip distance from the distinct pre-migratory roost to the first wintering ground roost was 4,303 miles (Table 1). Total duration of her fall migration to the wintering ground roost was 31 days with an average overall fall migration rate of 139 miles/day.

SPRING MIGRATION 2012

First night on spring migration was 6 April 2012. Spring migration pathway through Central America was similar to the fall migration pathway except for utilizing the northwest part of the Yucatan peninsula and reaching this point on 15 April (see map for 2331-84511). She took only one day to cross the Gulf over to the extreme coastal tip of Texas on 16 April. From this point, she took a pathway further west up through central Oklahoma and Kansas back to the colony site in only three days arriving on 19 April.

Table 2. Spring Migration from last winter roost - 2012.

Breeding Colony	Band No.	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Spring Migration (from last winter roost)	Arrival Date at Breeding Site	Spring Migration Total Distance (from last winter roost) (miles)	Spring Migration Total Duration (from last winter roost) (days)	Spring Migration Overall Rate (from last winter roost) (m/d)	Total Annual Migration Distance (miles) fall to first roost, spring from last roost
SD-SF	233184506	M	2	25-Mar	21-Apr	5265	28	188	9845
SD-SF	223184507	F	2	22-Apr	06-May	4450	15	296	9095
SD-SF	233184511	F	2	06-Apr	19-Apr	4633	14	331	8936
SD-C	233184518	F	2	07-Apr	27-Apr	4290	21	204	8838
SD-C	233184523	M	2	08-Apr	28-Apr	4964	21	236	10372
SD-C	233184528	M	2	18-Apr	01-May	4393	14	314	8222
SD-C	233184529	M	2	01-May	21-May	4697	21	224	9876
SD-C	233184530	M	2	12-Apr	04-May	5341	23	232	10265
SD-C	223184531	M	1	11-Apr	02-May	5180	22	235	10551

This spring migration total trip distance from the last wintering ground roost back to the colony site was 4,633 miles (Table 2). Total duration of her spring migration from the last wintering ground roost back to the colony site was a “rapid pace” of 14 days with an average overall spring migration rate of 331 miles/day. Her total migration distance from the fall pre-migratory roost to the wintering grounds and back to the colony site from the last wintering ground roost was 8,936 miles. We retrieved this geolocator from her on 19 May 2012 during our second attempt described earlier.

Columbia Colony Site 2012

Excitement levels were elevated for Paul at his colony with anticipation of returning Purple Martins carrying geolocators with the first sighting of an ASY martin on 8 April. This was the earliest return date at his colony. Weather conditions during April were very favorable for returning Purple Martins. The first sighting of a Purple Martin with a geolocator was on 27 April of an ASY female entering gourd numbers 3 and 14 which these are on a different system from the system (gourd # 26) she was originally captured from in 2011 for deployment.

She finally settled into gourd number 14 and proved to be more difficult to capture using the modified loop wire self-trapping mechanism to trip the trap door shut like being used for the other returning martins with geolocators. A modified "fishing" method was used to finally capture her. A fine wire had to be used instead of the pull string and had to be installed on the rack system to resemble other wires on the system. This wire had to be strung and laid out across the yard up to the kitchen window overlooking the system. On the early morning of 6 May, Paul was watching out the window from inside the house and notched this martin entering the gourd with the trap door set in place the day before. With the window opened and waiting for a good opportunity, he pulled on the wire to trip the trap door when she entered all the way into the gourd. Success! That was a fulfilling moment because she was now the fourth Purple Martin captured and geolocator retrieved from this colony site. Her band number is 2331-84518.

The second sighting of a Purple Martin carrying a geolocator occurred the next morning 28 April of an ASY male entering gourd number 34. No attempts at capturing Purple Martins with geolocators were made until it was evident that each one was claiming and using that particular compartment for a few days. This male continued claiming gourd number 34 which is by the way the same gourd he claimed in 2011 and was captured from for geolocator deployment. On 3 May, the self-setting trap door was set during heighten activity of going in and out of his gourd trying to attract a female. After setting the trap door, he finally entered and set the trap door down. This was exciting because he was the first-ever geolocator retrieved in South Dakota. His band number is 2331-84527.

The third sighting of a martin with a geolocator occurred the next day 29 April of an ASY male (which was a SY male in 2011) entering gourd numbers 10, 20, and 17. This male finally claimed gourd number 10 which is on the same gourd rack system used in 2011, but was originally captured from gourd number 6. On 3 May, the self-setting trap door mechanism was set and it did not take long for him to be the second Purple Martin with a geolocator retrieved. His band number is 2331-84531.

The forth sighting of a martin with a geolocator occurred the next day 30 April of an ASY male entering and claiming gourd number 5 which is from the same system used in 2011, but captured from gourd number 14 in 2011. On 4 May, the self-setting trap door mechanism was set and he was the third martin captured with the geolocator retrieved. His band number is 2331-84523.

The fifth sighting of a martin with a geolocator occurred on 5 May of an ASY male entering and claiming gourd number 31 which is from the same system and from the same gourd number used in 2011. His actual arrival date is not known for sure. On 6 May, the self- setting trap door mechanism was set and he was the fifth martin captured with geolocator retrieved. His band number is 2331-84530.

The sixth sighting of a martin with a geolocator occurred on 6 May of an ASY male entering and claiming gourd number 22 which is from the same system used in 2011, but captured from gourd number 20 in 2011. On 11 May, the self-setting trap door mechanism was set and he was the sixth martin captured with geolocator retrieved. His band number is 2331-84528.

The seventh sighting of a martin with a geolocator occurred in the morning of 21 May of an ASY male looking into and entering gourd numbers 17, 11, 5, and 23. This sighting was very surprising because the two backyard systems were about full with claiming pairs and with some egg laying already initiated by the time this martin returned. He was having a difficult time because of all the gourds he was inspecting were already claimed by other martins and were defending them. We felt the odds of him possibly leaving and not retrieving his geolocator were high if he could not claim a nesting compartment in the full backyard systems.

With continued watching and observing his behavior along with the other pairs claiming their compartments, on 26 May it was noted that this martin

was trying to claim gourd number 4 that was already claimed by a pair of SY martins. As the morning progress and around noon, the SY martins in gourd number 4 would be gone for extended periods of time out feeding. It was during this time the ASY male would enter gourd number 4 conducting "claiming behavior". This made us think of an idea of possibly trying to capture him during this time frame the next day if he was still in a claiming behavior of gourd number 4. On 27 May, time was spent watching to see if this situation was going to materialize again with the martins involved in gourd number 4. Sure enough, the SY martins were off feeding and this ASY martin with a geolocator was now entering gourd number 4 like before. So, the self-setting trap door mechanism was set. The activity of the gourd rack system being lowered made most of the Purple Martin pairs to come back to see what was going on. The SY male claiming gourd number 4 came back and went right into the gourd setting the trap door. The system was lowered again to release this SY male and re-set the trap door. This time when the system was raised the SY male was not interested in going into the gourd now which was a good thing for us. After things settled back down around the system and after about one half hour, the "target" ASY male martin came back to gourd number 4. At first he would land and just look into the gourd reluctant to enter. After a couple of times of doing this, he landed on the porch looking in part way and back out again. With him still on the porch landing, some activity with other martins convinced this martin to enter the gourd all of the way. Success! The trap door went down and the last martin with a geolocator was captured and the geolocator retrieved. A good reason why this martin was attempting to claim gourd number 4 is because he claimed gourd number 8 in 2011 which is very close to gourd number 4 and gourd number 8 was already claimed by another ASY pair.

Data from Geolocators

For the Columbia colony site, a total of 18 geolocators were deployed in 2011 with a total of 7 geolocators retrieved in 2012 (2 on 3 May; 1 on 4 May; 2 on 6 May; 1 on 11 May; and 1 on 27 May). The dates for the first sightings observed for returning Purple Martins with geolocators for the most part match up with the data recorded by the geolocators for the arrival dates back to the breeding colony. Dr. Stutchbury downloaded the data from each geolocator to produce the following migration maps. Each map will be identified by the band number from each individual Purple Martin.

2331-84518

As reported earlier, this Purple Martin (ASY female) was the first one sighted back to this breeding colony. This martin was captured from gourd number 14 which took more intuitive thinking as described earlier and is identified with band number 2331-84518 on the migration map. She was captured and geolocator removed on 6 May 2012.

It was a very exciting, gratifying, and rewarding moment receiving an email from Dr. Stutchbury congratulating us on the "first-ever" map detailing the migration pathway and migration timing on a Purple Martin from South Dakota. Dr. Stutchbury went on to say that she will be sending a second map within a few days, but the others will be forthcoming at a later time. She did give these preliminary points of interest on this "first-ever" migration for a South Dakota Purple Martin: (in her words)
1.) She crossed the Gulf both directions, despite breeding quite far west.

2.) Very rapid initial migration to Mexico (5 days) followed by a 2-week stop in eastern Yucatan.

3.) She used 4 different wintering sites; the southern one is an area to which birds from other eastern populations (PA, TX, and VA) have also been tracked.

4.) The final roost site was on the Rio Negro – also a heavily used region by other martin populations.

5.) Impressive pace of spring migration even for a martin: covered approximately 5,300 miles in about 16 days (330 mi/day, which even incudes the few stop days).

After capturing and retrieving the geolocator from her in gourd number 14 on 6 May 2012, she moved to a different system and successfully nested and fledged 4 young from wood house compartment number 10 in 2012.

FALL MIGRATION 2011

After capturing and deploying her with a geolocator from gourd number 26 on 27 June, she successfully nested and fledged 6 young before leaving the colony on 20 August (see map for 2331-84518).

Map for band number **2331-84518**

She took a more easterly route through Missouri, Arkansas, and Louisiana arriving on the coast in three days (23 August). She took two days to cross the Gulf of Mexico to reach the Yucatan peninsula on 25 August. Then she moved to the east side of the peninsula and took a two week rest before quickly moving through Central America reaching the first wintering ground roost on 28 September. She moved to a couple southerly winter roosts during her stay in Brazil before moving back up in the Amazon River area on 10 January 2012.

This fall migration total trip distance from breeding colony site to the first wintering ground roost was 4,548 miles (Table 1). Total duration of her fall migration to the wintering grounds was 39 days with an average fall migration rate of 117 miles/day.

Table 1. Fall Migration from colony or distinct roost - 2011.

Breeding Colony	Band No.	Year Deployed	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Fall Migration (from Colony or Roost)	Wintering Ground Arrival Date	Fall Migration Total Distance (from colony or distinct fall roost) (miles)	Fall Migration Total Duration (from colony or distinct fall roost) (days)	Fall Migration Overall Rate (from colony or distinct fall roost) (m/d)
SD-SF	233184506	2011	M	2	19-Aug	15-Sep	4580	27	170
SD-SF	223184507	2011	F	2	22-Aug	04-Oct	4645	44	106
SD-SF	233184511	2011	F	2	20-Aug	18-Sep	4303	31	139
SD-C	233184518	2011	F	2	21-Aug	28-Sep	4548	39	117
SD-C	233184523	2011	M	2	21-Aug	29-Sep	5408	40	135
SD-C	233184528	2011	M	2	14-Aug	19-Sep	3829	37	103
SD-C	233184529	2011	M	2	03-Sep	23-Oct	5179	51	101
SD-C	233184530	2011	M	2	02-Sep	05-Oct	4924	34	145
SD-C	223184531	2011	M	1	03-Sep	02-Oct	5371	30	179

SPRING MIGRATION 2012

First night on spring migration was 7 April. Spring migration through Central America followed closely the same pathway she took as on the fall migration spending 5 days (15 – 20 April) on east side of Yucatan before crossing the Gulf again in three days arriving on LA coast 23 April.

She spent two days on the coast before quickly following the same pathway back to the breeding colony arriving on 27 April in just two days.

This spring migration total trip distance from the last wintering ground roost back to the colony site was 4,290 miles (Table 2). Total duration of her spring migration back to the colony was 21 days with an average overall spring migration rate of 204 miles/day. Her total migration distance from the colony site to the wintering grounds and back to the colony site was 8,838 miles. We retrieved this geolocator from her on 6 May 2012.

Table 2. Spring Migration from last winter roost - 2012.

Breeding Colony	Band No.	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Spring Migration (from last winter roost)	Arrival Date at Breeding Site	Spring Migration Total Distance (from last winter roost) (miles)	Spring Migration Total Duration (from last winter roost) (days)	Spring Migration Overall Rate (from last winter roost) (m/d)	Total Annual Migration Distance (miles) fall to first roost, spring from last roost
SD-SF	233184506	M	2	25-Mar	21-Apr	5265	28	188	9845
SD-SF	223184507	F	2	22-Apr	06-May	4450	15	296	9095
SD-SF	233184511	F	2	06-Apr	19-Apr	4633	14	331	8936
SD-C	233184518	F	2	07-Apr	27-Apr	4290	21	204	8838
SD-C	233184523	M	2	08-Apr	28-Apr	4964	21	236	10372
SD-C	233184528	M	2	18-Apr	01-May	4393	14	314	8222
SD-C	233184529	M	2	01-May	21-May	4697	21	224	9876
SD-C	233184530	M	2	12-Apr	04-May	5341	23	232	10265
SD-C	223184531	M	1	11-Apr	02-May	5180	22	235	10551

2331-84527

As mentioned earlier, this male martin was the” first-ever” captured and retrieved geolocator in South Dakota. He was captured on 3 May 2012 from the same gourd (#34) he was captured from and deployed with a geolocator. Unfortunately, the battery in this geolocator failed and no data could be downloaded. After retrieving his geolocator, he moved over to an adjacent gourd (#33) on the same system. Along with his mate, three young were fledged in 2012.

Map for band number **2331-84531**

2331-84531

This ASY male captured from gourd number 10 on 3 May 2012 is the only SY (sub adult) deployed in 2011 with a geolocator that has returned. He did return to the same gourd rack system, but claimed a different gourd than from the gourd (gourd # 6) claimed in 2011. After capturing and retrieving the geolocator from him in gourd number 10, he moved to gourd number 20 in the same system and successfully nested and fledged 5 young in 2012.

FALL MIGRATION 2011

After capturing and deploying him with a geolocator on 27 June 2011, he successfully nested and fledged 3 young before leaving the colony on 2 September (see map for 2331-84531). He "rocketed" to the Texas coast with his first night on fall migration from the colony on 3 September. He followed the coastline down through Mexico and Central America with a more leisured pace making a number of stops along the way until reaching the first wintering ground roost in Brazil on 2 October. He stayed at this first winter roost till 6 January when he moved up to the mouth of the Amazon River area staying at a couple of winter roosts until 10 April.

Table 1. Fall Migration from colony or distinct roost - 2011.

Breeding Colony	Band No.	Year Deployed	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Fall Migration (from Colony or Roost)	Wintering Ground Arrival Date	Fall Migration Total Distance (from colony or distinct fall roost) (miles)	Fall Migration Total Duration (from colony or distinct fall roost) (days)	Fall Migration Overall Rate (from colony or distinct fall roost) (m/d)
SD-SF	233184506	2011	M	2	19-Aug	15-Sep	4580	27	170
SD-SF	223184507	2011	F	2	22-Aug	04-Oct	4645	44	106
SD-SF	233184511	2011	F	2	20-Aug	18-Sep	4303	31	139
SD-C	233184518	2011	F	2	21-Aug	28-Sep	4548	39	117
SD-C	233184523	2011	M	2	21-Aug	29-Sep	5408	40	135
SD-C	233184528	2011	M	2	14-Aug	19-Sep	3829	37	103
SD-C	233184529	2011	M	2	03-Sep	23-Oct	5179	51	101
SD-C	233184530	2011	M	2	02-Sep	05-Oct	4924	34	145
SD-C	223184531	2011	M	1	03-Sep	02-Oct	5371	30	179

This fall migration total trip distance from colony to the first wintering ground roost was 5,371 miles (Table 1). Total duration of his fall migration to the wintering grounds was 30 days with an average overall fall migration rate of 179 miles/day.

SPRING MIGRATION 2012

First night on spring migration was 11 April. Spring migration followed closely the fall migration pathway through South America and Central America. He traveled through Central America in just five days (20 April – 25 April). He then followed the Mexico coastline up to near the southern tip of Texas on 28 April. From this spot, he headed straight north reaching back to the colony site in four days (2 May).

This spring migration total trip distance from the last wintering ground roost back to the breeding colony was 5,180 miles (Table 2).

Table 2. Spring Migration from last winter roost - 2012.

Breeding Colony	Band No.	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Spring Migration (from last winter roost)	Arrival Date at Breeding Site	Spring Migration Total Distance (from last winter roost) (miles)	Spring Migration Total Duration (from last winter roost) (days)	Spring Migration Overall Rate (from last winter roost) (m/d)	Total Annual Migration Distance (miles) fall to first roost, spring from last roost
SD-SF	233184506	M	2	25-Mar	21-Apr	5265	28	188	9845
SD-SF	223184507	F	2	22-Apr	06-May	4450	15	296	9095
SD-SF	233184511	F	2	06-Apr	19-Apr	4633	14	331	8936
SD-C	233184518	F	2	07-Apr	27-Apr	4290	21	204	8838
SD-C	233184523	M	2	08-Apr	28-Apr	4964	21	236	10372
SD-C	233184528	M	2	18-Apr	01-May	4393	14	314	8222
SD-C	233184529	M	2	01-May	21-May	4697	21	224	9876
SD-C	233184530	M	2	12-Apr	04-May	5341	23	232	10265
SD-C	223184531	M	1	11-Apr	02-May	5180	22	235	10551

Total duration of his spring migration back to the colony site was 22 days with an average overall spring migration rate of 235 miles/day. His total migration distance from the colony site to the first wintering ground roost and back to the colony site from the last wintering ground roost was 10,551 miles. We retrieved this geolocator from him on 3 May 2012.

2331-84523

This ASY male was captured and geolocator retrieved from gourd number 5 on 4 May 2012. He returned to the same gourd rack system, but claimed a different gourd (#5) than from the one he claimed in 2011 (gourd #14). He continued to claim gourd number 5 for the 2012 season.

This was the second map Dr. Stutchbury sent for a Purple Martin from SD and she gave these preliminary points of interest on the "second-ever" map.

1.) He raced down to the Yucatan in less than a week, took a one-week "vacation" in coastal Honduras/Nicaragua then flew quite far south where other martins winter near this spot, but most geolocator birds so far have wintered along the Amazon River.

2.) He moved Northward over the winter, occupying two additional roost sites.

3.) Interestingly, in spring he took the overland route instead of crossing the Gulf of Mexico. Other martins have done this, but it is uncommon for the martins from eastern populations like PA and VA.

After capturing and retrieving the geolocator from him in gourd number 5, he continued to claim gourd number 5 and successfully nested and fledged 5 young in 2012.

FALL MIGRATION 2011

After capturing and deploying this martin with a geolocator on 27 June, he successfully nested and fledged 4 young before leaving the colony site on 28 July (see map for 2331-84523). After leaving the colony site, he spent time in a pre-migratory roost from 30 July – 20 August that appears could be a roost location in or near the city of Sioux Falls. We did document a newer location for a roost in Sioux Falls in 2012 near the Good Samaritan Society on 57th street. The first documented roost was on Gateway Blvd. in 2006 (Mammenga 2007).

Map for band number **2331-84523**

Purple Martins gathering above the roost trees in Sioux Falls during August 2012.

The first night on fall migration from this pre-migratory roost was on 21 August. After leaving the roost, it took him only three days to reach the LA coast on 23 August. He then crossed the Gulf in two days reaching the Yucatan peninsula on 25 August. It took him one week to travel through Central America before heading to South America on 3 September. He spent most of September traveling a great distance further south compared to the other martins with geolocators wintering in the Amazon region. He arrived in this southerly winter roost 29 September. He did move to a couple of other wintering roosts in a northwest direction staying in the last roost until 7 April.

This fall migration total trip distance from the distinct pre-migratory roost to the first wintering ground roost was 5,408 miles (Table 1). Total duration of his fall migration to the wintering grounds was 40 days with an average overall fall migration rate of 135 miles/day.

Table 1. Fall Migration from colony or distinct roost - 2011.

Breeding Colony	Band No.	Year Deployed	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Fall Migration (from Colony or Roost)	Wintering Ground Arrival Date	Fall Migration Total Distance (from colony or distinct fall roost) (miles)	Fall Migration Total Duration (from colony or distinct fall roost) (days)	Fall Migration Overall Rate (from colony or distinct fall roost) (m/d)
SD-SF	233184506	2011	M	2	19-Aug	15-Sep	4580	27	170
SD-SF	223184507	2011	F	2	22-Aug	04-Oct	4645	44	106
SD-SF	233184511	2011	F	2	20-Aug	18-Sep	4303	31	139
SD-C	233184518	2011	F	2	21-Aug	28-Sep	4548	39	117
SD-C	233184523	2011	M	2	21-Aug	29-Sep	5408	40	135
SD-C	233184528	2011	M	2	14-Aug	19-Sep	3829	37	103
SD-C	233184529	2011	M	2	03-Sep	23-Oct	5179	51	101
SD-C	233184530	2011	M	2	02-Sep	05-Oct	4924	34	145
SD-C	223184531	2011	M	1	03-Sep	02-Oct	5371	30	179

SPRING MIGRATION 2012

First night on spring migration was 8 April. He traveled in a northwest direction across South America. It took him about one week to travel through Central America and continued traveling around coastal Mexico and Texas up to the southeastern coastal area of Texas arriving on 25 April. From this point, he headed due north taking only three days to arrive back at the breeding colony site on 28 April.

The spring migration total trip distance from the last wintering ground roost back to the colony site was 4,964 miles (Table 2). Total duration of his spring migration back to the colony was 21 days with an average overall spring migration rate of 236 miles/day. His total migration distance from the fall pre-migratory roost site to the first wintering ground roost and from the last wintering ground roost back to the colony site was 10,372 miles. We retrieved this geolocator from him on 4 May 2012.

Table 2. Spring Migration from last winter roost - 2012.

Breeding Colony	Band No.	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Spring Migration (from last winter roost)	Arrival Date at Breeding Site	Spring Migration Total Distance (from last winter roost) (miles)	Spring Migration Total Duration (from last winter roost) (days)	Spring Migration Overall Rate (from last winter roost) (m/d)	Total Annual Migration Distance (miles) fall to first roost, spring from last roost
SD-SF	233184506	M	2	25-Mar	21-Apr	5265	28	188	9845
SD-SF	223184507	F	2	22-Apr	06-May	4450	15	296	9095
SD-SF	233184511	F	2	06-Apr	19-Apr	4633	14	331	8936
SD-C	233184518	F	2	07-Apr	27-Apr	4290	21	204	8838
SD-C	233184523	M	2	08-Apr	28-Apr	4964	21	236	10372
SD-C	233184528	M	2	18-Apr	01-May	4393	14	314	8222
SD-C	233184529	M	2	01-May	21-May	4697	21	224	9876
SD-C	233184530	M	2	12-Apr	04-May	5341	23	232	10265
SD-C	223184531	M	1	11-Apr	02-May	5180	22	235	10551

2331-84530

This ASY male was captured with geolocator retrieved on 6 May 2012 from gourd number 31. This was the same gourd he was captured from in 2011 when geolocators were deployed. After capturing and retrieving the geolocator from him in gourd number 31, he continued to claim gourd number 31and successfully nested and fledged 6 young in 2012.

FALL MIGRATION 2011

After capturing and deploying him with a geolocator, he successfully nested and fledged 6 young in 2011 before leaving the colony on 1 September (see map for 2331-84530). He traveled through eastern Nebraska with his first night on fall migration from the colony on 2 September. He made a "speedy" three day trip down to the Texas coast on 4 September. He then took three days to travel around the Gulf along the Mexico coast arriving on the eastern side of the Yucatan peninsula on 7 September. He took a good two weeks "vacation" at this location before traveling through Central America in just four days.

Map for band number **2331-84530**

He arrived on the first wintering ground roost in the Amazon River on 5 October. He stayed at the first winter roost till 30 January when he moved further east to a second winter roost on 5 February staying at this location until 11 April.

This fall migration total trip distance from the colony site to the first wintering ground roost was 4,924 miles (Table 1). Total duration of his fall migration to the wintering grounds was 34 days with an average overall fall migration rate of 145 miles/day.

Table 1. Fall Migration from colony or distinct roost - 2011.

Breeding Colony	Band No.	Year Deployed	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Fall Migration (from Colony or Roost)	Wintering Ground Arrival Date	Fall Migration Total Distance (from colony or distinct fall roost) (miles)	Fall Migration Total Duration (from colony or distinct fall roost) (days)	Fall Migration Overall Rate (from colony or distinct fall roost) (m/d)
SD-SF	233184506	2011	M	2	19-Aug	15-Sep	4580	27	170
SD-SF	223184507	2011	F	2	22-Aug	04-Oct	4645	44	106
SD-SF	233184511	2011	F	2	20-Aug	18-Sep	4303	31	139
SD-C	233184518	2011	F	2	21-Aug	28-Sep	4548	39	117
SD-C	233184523	2011	M	2	21-Aug	29-Sep	5408	40	135
SD-C	233184528	2011	M	2	14-Aug	19-Sep	3829	37	103
SD-C	233184529	2011	M	2	03-Sep	23-Oct	5179	51	101
SD-C	233184530	2011	M	2	02-Sep	05-Oct	4924	34	145
SD-C	223184531	2011	M	1	03-Sep	02-Oct	5371	30	179

SPRING MIGRATION 2012

First night on spring migration was 12 April. Spring migration pretty much followed the same route as the fall migration through South America and Central America but at a faster pace arriving 30 April at the southern tip of Texas. From this location, it took him only four days to arrive back to the breeding colony site on 4 May.

This spring migration total trip distance from the last wintering ground roost back to the colony site was 5,341 miles (Table 2). Total duration of his

spring migration back to the colony was 23 days with an average overall spring migration rate of 232 miles/day. His total migration distance from the colony site to the wintering grounds and back to the colony site from the last wintering roost was 10,265 miles. We retrieved this geolocator from him on 6 May 2012.

Table 2. Spring Migration from last winter roost - 2012.

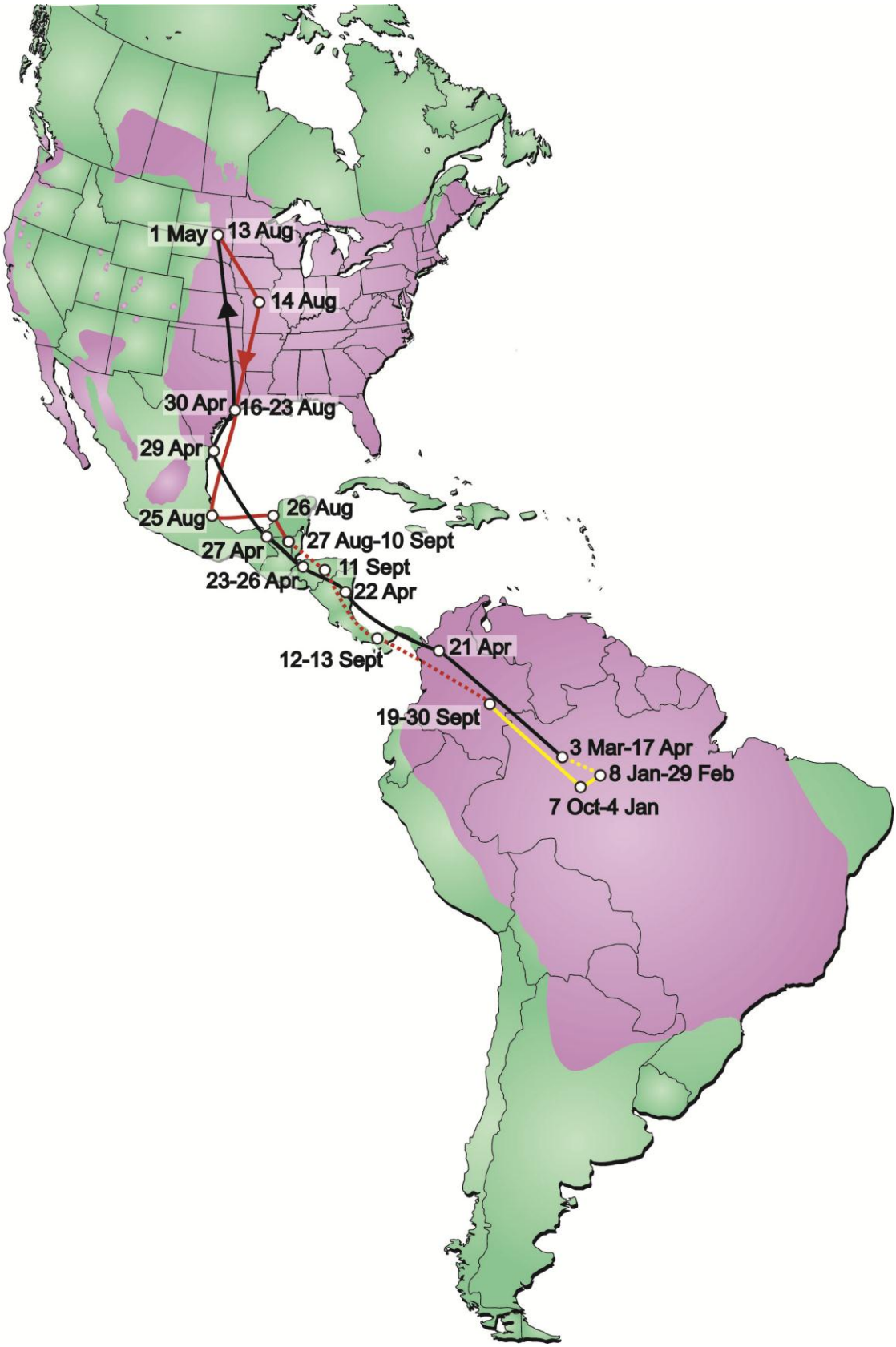
Breeding Colony	Band No.	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Spring Migration (from last winter roost)	Arrival Date at Breeding Site	Spring Migration Total Distance (from last winter roost) (miles)	Spring Migration Total Duration (from last winter roost) (days)	Spring Migration Overall Rate (from last winter roost) (m/d)	Total Annual Migration Distance (miles) fall to first roost, spring from last roost
SD-SF	233184506	M	2	25-Mar	21-Apr	5265	28	188	9845
SD-SF	223184507	F	2	22-Apr	06-May	4450	15	296	9095
SD-SF	233184511	F	2	06-Apr	19-Apr	4633	14	331	8936
SD-C	233184518	F	2	07-Apr	27-Apr	4290	21	204	8838
SD-C	233184523	M	2	08-Apr	28-Apr	4964	21	236	10372
SD-C	233184528	M	2	18-Apr	01-May	4393	14	314	8222
SD-C	233184529	M	2	01-May	21-May	4697	21	224	9876
SD-C	233184530	M	2	12-Apr	04-May	5341	23	232	10265
SD-C	223184531	M	1	11-Apr	02-May	5180	22	235	10551

2331-84528

This ASY male was captured with the geolocator retrieved on 11 May 2012 from gourd number 22. He returned to the same gourd rack system, but claimed a different gourd now then from the one he claimed in 2011 (gourd number 20) when geolocators were deployed. After capturing and retrieving the geolocator from him in gourd number 22, he continued to claim gourd number 22 and successfully nested and fledged 5 young in 2012.

FALL MIGRATION 2011

After capturing and deploying him with the geolocator, he successfully nested and fledged 6 young in 2011 before leaving the colony on 13 August (see map for 2331-84528).



Map for band number **2331-84528**

He traveled southeast reaching northern Missouri on 14 August his first night on fall migration from the colony. He made a fast trip down to the Texas coastline reaching this location on 16 August. This was a three day trip from the colony. He spent a week at the Texas location before taking a two day journey across the western edge of the Gulf reaching the central Mexico coast area on 25 August. He then traveled east to the Yucatan peninsula in one day (26 August). He took a leisurely pace through Central America finally reaching the first wintering ground roost on 19 September. He moved to a second wintering ground roost in the Amazon area on 7 October and stayed through 4 January. He then moved to a third roost from 8 January through 29 February. The last winter roost he stayed was from 3 March through 17 April before heading on spring migration.

This fall migration total trip distance from the colony site to the first wintering ground roost was 3,829 miles (Table 1.). Total duration of his fall migration to the wintering grounds was 37 days with an average overall fall migration rated of 103 miles/day.

Table 1. Fall Migration from colony or distinct roost - 2011.

Breeding Colony	Band No.	Year Deployed	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Fall Migration (from Colony or Roost)	Wintering Ground Arrival Date	Fall Migration Total Distance (from colony or distinct fall roost) (miles)	Fall Migration Total Duration (from colony or distinct fall roost) (days)	Fall Migration Overall Rate (from colony or distinct fall roost) (m/d)
SD-SF	233184506	2011	M	2	19-Aug	15-Sep	4580	27	170
SD-SF	223184507	2011	F	2	22-Aug	04-Oct	4645	44	106
SD-SF	233184511	2011	F	2	20-Aug	18-Sep	4303	31	139
SD-C	233184518	2011	F	2	21-Aug	28-Sep	4548	39	117
SD-C	233184523	2011	M	2	21-Aug	29-Sep	5408	40	135
SD-C	233184528	2011	M	2	14-Aug	19-Sep	3829	37	103
SD-C	233184529	2011	M	2	03-Sep	23-Oct	5179	51	101
SD-C	233184530	2011	M	2	02-Sep	05-Oct	4924	34	145
SD-C	223184531	2011	M	1	03-Sep	02-Oct	5371	30	179

SPRING MIGRATION 2012

First night on spring migration was 18 April. The spring migration pathway pretty much followed the fall migration pathway through Central America but with a faster pace of only 10 days reaching the southern tip of Texas on 29 April. From here he "shot" straight north reaching back to the breeding colony in only two days on 1 May.

This spring migration total trip distance from the last wintering ground roost back to the colony site was 4,393 miles (Table 2). Total duration of his spring migration back to the colony was 14 days with an average overall spring migration rate of 314 miles/day. His total migration distance from the colony site to the first wintering ground roost and back to the colony site from the last wintering ground roost was 8,222 miles. We retrieved this geolocator from him on 11 May 2012.

Table 2. Spring Migration from last winter roost - 2012.

Breeding Colony	Band No.	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Spring Migration (from last winter roost)	Arrival Date at Breeding Site	Spring Migration Total Distance (from last winter roost) (miles)	Spring Migration Total Duration (from last winter roost) (days)	Spring Migration Overall Rate (from last winter roost) (m/d)	Total Annual Migration Distance (miles) fall to first roost, spring from last roost
SD-SF	233184506	M	2	25-Mar	21-Apr	5265	28	188	9845
SD-SF	223184507	F	2	22-Apr	06-May	4450	15	296	9095
SD-SF	233184511	F	2	06-Apr	19-Apr	4633	14	331	8936
SD-C	233184518	F	2	07-Apr	27-Apr	4290	21	204	8838
SD-C	233184523	M	2	08-Apr	28-Apr	4964	21	236	10372
SD-C	233184528	M	2	18-Apr	01-May	4393	14	314	8222
SD-C	233184529	M	2	01-May	21-May	4697	21	224	9876
SD-C	233184530	M	2	12-Apr	04-May	5341	23	232	10265
SD-C	223184531	M	1	11-Apr	02-May	5180	22	235	10551

2331-84529

This ASY male was captured with geolocator retrieved on 27 May 2012 from gourd number 4. As described earlier, this male was the last one sighted with a geolocator that arrived late (21 May) back to the breeding colony. Most all of the nesting gourds and compartments were already claimed for the season in the two systems in the backyard. He was investigating a number of gourds from the same system he was captured from and deployed with a geolocator in 2011 from gourd number 8. He was successful in nesting and fledging 4 young in 2011.

As described earlier, he was eventually captured with geolocator retrieved from him. After this event, he decided to move to the new front yard system where he claimed compartment number 8 in the wood house. He paired with a SY female and had 5 eggs on 17 June. Something happened to the female and this male after a few days left the colony. Of all the returning Purple Martins with geolocators at this colony (7), this ASY male was the only one unsuccessful in nesting in 2012.

FALL MIGRATION 2011

After capturing and deploying him with the geolocator, he successfully nested and fledged 4 young in 2011 before leaving the colony on 13August (see map for 2331-84529). He spent time at a pre-migratory roost to the east of the colony near the SD – MN border from 14 August through 2 September. We learned from the PMCA about viewing Nexrad radar in our region to possibly see potential pre-migratory roosts with the characteristic round "doughnut" formation that appears on radar as the martins leave the roost in early mornings going out in all directions to feed (Tautin 2005). The radar and the data from this martin does confirm a roost site in this region where this male spent some time before leaving on fall migration. With this information, we spent three different days in late August of 2012 to locate the roost site but were unsuccessful.

The first night on fall migration from this pre-migratory roost was in southern Iowa on 3 September. He traveled south reaching near the Texas coastline in just three days (5 September). He then traveled south along the western edge of the Gulf to lower Mexico in just one day 6 September. He then traveled to the eastern side of the Yucatan and took a month rest from migration staying from 8 September through the 9 October.

Map for band number **2331-84529**

He traveled in a southeast direction reaching the wintering ground area of the Amazon region on 23 October. He stayed in this wintering ground roost until 10 December. He then moved to a second wintering ground roost further to the southeast arriving 14 December and staying until 2 April. He then headed back in a northwest direction to spend time at a third wintering ground roost from 12 April through 19 April. The last wintering ground roost was back on the Amazon River region with time spent there from 20 April through 30 April.

This fall migration total trip distance from the pre-migratory roost to the first wintering ground roost was 5,179 miles (Table 1). Total duration of his fall migration from the pre-migratory roost to the first wintering ground roost was 51 days with an average overall fall migration rate of 101miles/day.

Table 1. Fall Migration from colony or distinct roost - 2011.

Breeding Colony	Band No.	Year Deployed	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Fall Migration (from Colony or Roost)	Wintering Ground Arrival Date	Fall Migration Total Distance (from colony or distinct fall roost) (miles)	Fall Migration Total Duration (from colony or distinct fall roost) (days)	Fall Migration Overall Rate (from colony or distinct fall roost) (m/d)
SD-SF	233184506	2011	M	2	19-Aug	15-Sep	4580	27	170
SD-SF	223184507	2011	F	2	22-Aug	04-Oct	4645	44	106
SD-SF	233184511	2011	F	2	20-Aug	18-Sep	4303	31	139
SD-C	233184518	2011	F	2	21-Aug	28-Sep	4548	39	117
SD-C	233184523	2011	M	2	21-Aug	29-Sep	5408	40	135
SD-C	233184528	2011	M	2	14-Aug	19-Sep	3829	37	103
SD-C	233184529	2011	M	2	03-Sep	23-Oct	5179	51	101
SD-C	233184530	2011	M	2	02-Sep	05-Oct	4924	34	145
SD-C	223184531	2011	M	1	03-Sep	02-Oct	5371	30	179

SPRING MIGRATION 2012

First night on spring migration was 1 May. The spring migration closely followed the fall migration pathway this ASY male took. Upon leaving the last wintering ground roost, it took him 18 days to travel to southern Texas (18 May). He made it back to the breeding colony site after leaving Texas in only three days arriving on 21 May.

This spring migration total trip distance from the last wintering ground roost back to the colony site was 4,697 miles (Table 2). Total duration of his spring migration from the last wintering ground roost back to the breeding colony was 21 days with an average overall spring migration rate of 224 miles/day. His total migration distance from the pre-migratory fall roost to the first wintering ground roost and back to the colony site from the last wintering ground roost was 9,876 miles. We retrieved this geolocator from him on 27 May 2012.

Table 2. Spring Migration from last winter roost - 2012.

Breeding Colony	Band No.	Sex	Age at Deployment (1=SY, 2=ASY)	First Night on Spring Migration (from last winter roost)	Arrival Date at Breeding Site	Spring Migration Total Distance (from last winter roost) (miles)	Spring Migration Total Duration (from last winter roost) (days)	Spring Migration Overall Rate (from last winter roost) (m/d)	Total Annual Migration Distance (miles) fall to first roost, spring from last roost
SD-SF	233184506	M	2	25-Mar	21-Apr	5265	28	188	9845
SD-SF	223184507	F	2	22-Apr	06-May	4450	15	296	9095
SD-SF	233184511	F	2	06-Apr	19-Apr	4633	14	331	8936
SD-C	233184518	F	2	07-Apr	27-Apr	4290	21	204	8838
SD-C	233184523	M	2	08-Apr	28-Apr	4964	21	236	10372
SD-C	233184528	M	2	18-Apr	01-May	4393	14	314	8222
SD-C	233184529	M	2	01-May	21-May	4697	21	224	9876
SD-C	233184530	M	2	12-Apr	04-May	5341	23	232	10265
SD-C	223184531	M	1	11-Apr	02-May	5180	22	235	10551

Summary of all Migrations

From the 33 geolocators deployed for the "first-time" ever on Purple Martins from South Dakota in 2011, a total of 10 geolocator devices were retrieved from returning Purple Martins in 2012. Of the 10 geolocators recovered, only 9 could the data be retrieved to document individual Purple Martin migrations from each respective colony site deployed from.

Sioux Falls colony site

For the three Purple Martins with geolocators from this colony site, the average fall migration distance was 4,509 miles which took an average duration of 34 days (Table 3). The fall migration distance traveled by these three Purple Martins ranged from 4,303 miles to 4,645 miles with a range in duration from 27 days to 44 days (Table 1). The overall fall migration rate (miles/day) covered by these Purple Martins ranged from 106 miles/day to 170 miles/day.

Table 3. SD Purple Martin Migration Total Averages.

Breeding Colony	Fall Migration Total Average Distance (from colony or distinct fall roost) (miles)	Fall Migration Total Average Duration (from colony or distinct fall roost) (days)	Spring Migration Total Average Distance from last winter roost (miles)	Spring Migration Total Average Duration (from last winter roost) (days)	Total Annual Migration Average Distance (miles) fall to first roost, spring from last roost
Sioux Falls	4509	34	4783	19	9292
Columbia	4877	39	4811	20	9688
Combined	4754	37	4801	20	9555

The average spring migration distance traveled by these three Purple Martins was 4,783 miles which took an average duration of 19 days (Table 3).

The spring migration distance traveled ranged from 4,450 miles to 5,265 miles with a range in duration from 14 days to 28 days (Table 2). The spring migration average distance (4,783 miles) was 274 miles longer than the fall migration average distance (4,509 miles), but the pace of the returning Purple Martins back to the breeding colony took only 19 days compared to the average fall migration pace of 34 days. The overall spring migration rate (miles/day) covered by these Purple Martins ranged from 188 miles/day to 331 miles/day.

The total annual migration average distance covered by these three Purple Martins from this colony site was 9,292 miles which ranged from 8,936 miles to 9,845 miles.

Columbia colony site

This colony site is located further north 200 miles from the Sioux Falls colony site. For the six Purple Martins with functioning geolocators from this colony site, the average fall migration distance was 4,877 miles which took an average duration of 39 days (Table 3). The fall migration distance traveled by these six Purple Martins ranged from 3,829 miles to 5,408 miles with a range in duration from 30 days to 51 days (Table 1). The overall fall migration rate (miles/day) covered by these Purple Martins ranged from 101 miles/day to 179 miles/day.

The average spring migration distance traveled by these six Purple Martins was 4,811 miles which took an average duration of 20 days (Table 3). The spring migration distance traveled ranged from 4,290 miles to 5,341 miles with a range in duration from 14 days to 23 days (Table 2). The spring migration average distance traveled (4,811 miles) for the Purple Martins from this colony site was very similar to the fall migration average distance traveled (4,877 miles), but the pace in average days to return to the breeding colony in the spring was only 20 days compared to the average fall migration of 39 days. The Purple Martins traveled back to the breeding colony twice as fast in the spring. The overall spring migration rate (miles/day) covered by these Purple Martins ranged from 204 miles/day to 314 miles/day.

The total annual migration average distance covered by these six Purple Martins from this colony site was 9,688 miles which ranged from 8,222 miles to 10,551 miles.

South Dakota Purple Martin Migrations Combined

For all 9 Purple Martins with functioning geolocators retrieved in South Dakota combined, the average fall migration distance was 4,754 miles which took an average duration of 37 days compared to the average spring migration distance of 4,801 miles with an average duration of 20 days (Table 3). Even though the average distance traveled during the fall and spring migrations are similar, the time (duration in days) spent migrating occurs at a much faster pace during the spring return to the breeding colonies. The total annual migration average distance traveled from breeding colonies in South Dakota to wintering grounds and back to the breeding colonies was 9,555 miles.

Discussion

A very successful collaborating team materialized during this project on current "state-of-art" geolocator research for Purple Martin conservation. This team consisted of not only between us as "hobbyist" landlords hosting Purple Martins in SD and with PMCA, York University, and SDGFP, but with other individual landlords from NJ, VA, MN, OK, and TX. In a sense, this project was only the beginning of a team effort that will be continuing with further geolocator research for Purple Martin conservation.

In January 2012, Dr. Stutchbury sent an email investigating our interest in continued geolocator research on Purple Martins, especially on "multiple" migrations on returning Purple Martins with geolocators expecting in 2012 from our colony locations in SD. York University is excited to document and learn about two annual migrations from the same individual Purple Martin across their breeding range in North America. Do individual martins take the same pathways and use the same wintering ground locations?

We felt privileged to be asked in providing an opportunity in continued collaboration in pursuit of future geolocator research and knowledge on Purple Martins with such a prestigious group. We proposed to SDGFP Wildlife Diversity staff the possibility of dispersing the final portion ($1000)

of the grant funding to us ahead of the designated time for purchase of 5 new geolocators for participation in this "multiple" migration research on Purple Martins from South Dakota. With this opportunity to receive the last appropriation of this funding towards more geolocator devices, we advised Dr. Stutchbury that we would commit to the purchasing of 5 geolocators for the multiple migration research on Purple Martins from South Dakota. Dr. Stutchbury was very pleased to learn of our commitment to fund 5 geolocators that York University was willing to donate 10 additional geolocators for SD. This would give a total of 15 geolocators for returning SD Purple Martins expected in 2012. York University was hoping for a 50 percent return rate and the 15 geolocators would be enough to cover all returning Purple Martins with geolocators for SD.

We were pretty much "awe-struck" in the quality of this project had become. Not only were we going to have to be ready for returning Purple Martins with geolocators deployed in 2011 from this project, but to also recapture again these same martins after capturing them to retrieve the geolocators to re-deploy them with a new geolocator before they depart in 2012. As we finished retrieving geolocators from returning Purple Martins and with approaching final re-deployment plans with York University, we were surprised to learn that York University was going to donate not only the 10 geolocators plus the 5 we purchased, they were going to increase sample size for re-deployment and new deployments for South Dakota to a total of 20 geolocators. Therefore, the deployment of geolocators in 2012 would consist of 15 donated geolocators from York University and the 5 this project funded. The total funding for this project all went to cover the cost of 32 geolocators deployed, while York University donated a total of 21 geolocators for 2011 and 2012. We never imagined that with this project we would be involved with deployment of 53 geolocators for migration knowledge and research on Purple Martins from South Dakota.

How did the re-deployment of geolocators for "multiple" migration research go? We had 10 Purple Martins that could potentially be re-deployed with another geolocator in June of 2012, but only 9 had functioning geolocators with data to document possible multiple migrations.

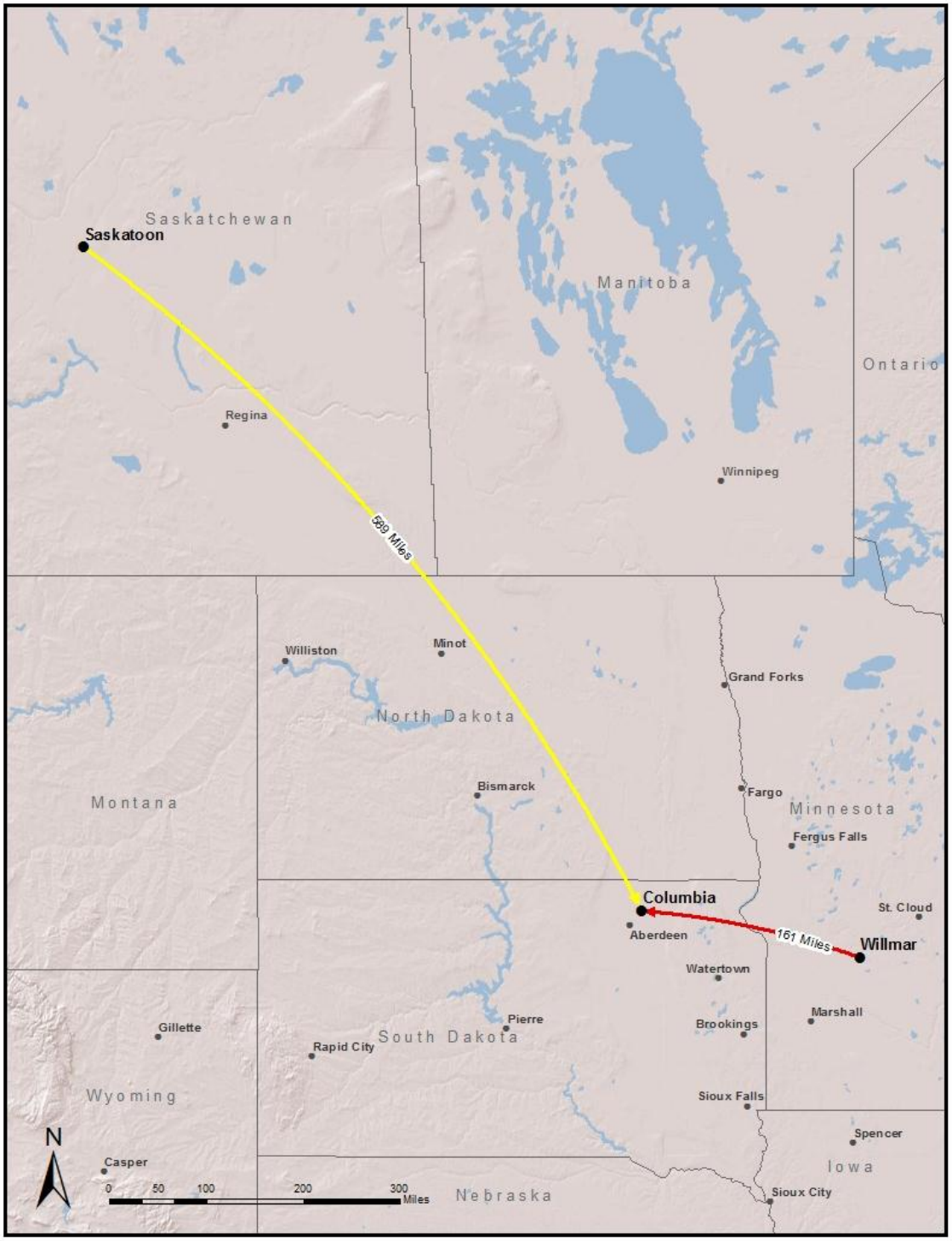
At the Columbia colony site, there were 7 Purple Martins with geolocators retrieved in May 2012. Of these 7 martins, six were actually re-deployed with a new geolocator on 21 June 2012. Of the Purple Martins re-deployed, only 5 will have the potential of documented multiple migration trips

because one Purple Martin (band number 2331-84527) had a dead battery in its geolocator device resulting in no retrievable data in 2012. Also on 21 June 2012 at the Columbia colony, nine new Purple Martins were deployed with geolocators making a total of 15 Purple Martins departing this colony site with geolocators and awaiting return in 2013. Of these 15 Purple Martins deployed, 10 were ASY males and 5 were ASY females.

At the Sioux Falls colony site, there were 3 Purple Martins with geolocators retrieved in May 2012. Of these three Purple Martins, two were re-deployed with new geolocators on 24 June 2012 and will have potential to document multiple migration trips. Also on 24 June at this colony site, two new Purple Martins were deployed with geolocators making a total of 5 Purple Martins departing this colony and awaiting return in 2013. Of these 5 Purple Martins deployed, 3 were ASY males and 2 were ASY females.

As the long wait is on now for the return of the Purple Martins in 2013 especially for any of the 20 with geolocators (13 ASY males and 7 ASY females), we are hopeful for a good return rate but realize the odds for the 8 Purple Martins that were re-deployed will be reduced because of lower possible survival resulting from carrying the devices again on a second long migration trip.

Another collaborative effort to materialize as a result of this project is the interest to learn more about Purple Martins from SD came about from two banded Purple Martins documented from the Columbia colony site in 2011. It began in early morning of 7 May 2011 when two ASY males were battling over a nesting compartment in the wooden house with one ending on the ground in very wet grass. The feathers on this martin were too wet for him to obtain flight from the ground. Paul went out with paper napkins and captured and held him in the napkins to absorb the moisture. While Paul was holding the martin and turning the martin around, Paul noticed the martin had a leg band. From this band, he learned that this martin was banded as a nestling on 9 July 2008 at Jerry Parent's colony 9 miles south of Saskatoon, SK (Parent 2011). This represented a natal dispersal of 589 miles from Jerry's colony site (Mammenga 2011) to Paul's colony site (see natal dispersal map). This ASY male paired and successfully nested and fledged 4 young from the Columbia colony site in 2011. This was exciting to learn of a banded Purple Martin from Canada settled at a South Dakota colony to breed.



Map showing natal dispersal to the Columbia colony site.

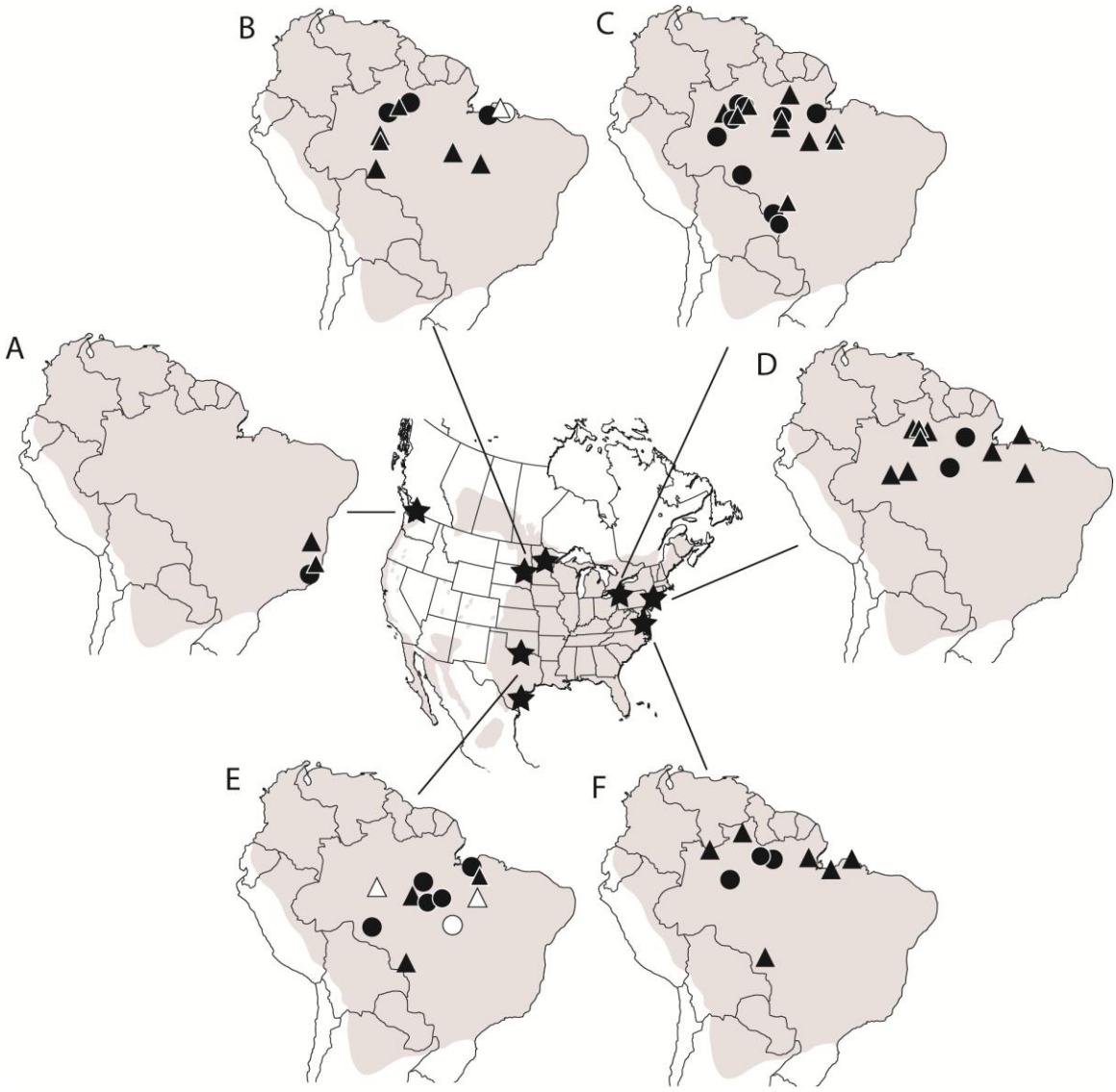
As more Purple Martins continued to arrive at the Columbia colony site, Paul continued to look for more banded Purple Martins. To his surprise on 22 May 2011, he sighted another banded martin but this time it was a SY (sub adult) male with not just one leg band but with a red color leg band also. Using a spotting scope, Paul was able to read the letters and numbers from the red leg band. Paul submitted this information and found out that this martin was banded as a nestling on 1 July 2010 at Dick Doll's colony site near Willmar, MN (map for natal dispersal). This documented a natal dispersal of 161 miles from the Willmar colony to the Columbia colony site. This male paired with a SY female and they successfully nested and fledged 4 young from the Columbia colony in 2011.

With a collaborative effect with Eileen Dowd Stukel at SD GFP, a study on natal dispersal of banded Purple Martin nestlings from active colony sites in SD was developed and initiated in the summer of 2012. The main objective for this study is to band approximately 400 to 500 nestlings annually from active colony sites in SD. Yellow colored leg bands coded (black) in the same fashion as described for those used on Purple Martins deployed with geolocators would use the same protocol except for the use of 3 numbers instead of 2.

Banding of nestlings occurred at three active colony sites in 2012. The two study colonies for this study (Sioux Falls and Columbia) and one active colony located in Menno were selected for banding efforts. On 19 June, 29 Purple Martin nestlings were banded at the Menno colony site (Luverne Mammenga). A total of 72 Purple Martin nestlings were banded at the Sioux Falls colony site on 23 June. Throughout the pre-fledging period (June-July) when the nestlings were at least 15 days old, a total of 241 Purple Martin nestlings were banded at the Columbia colony site. For 2012, a grand total of 342 Purple Martin nestlings were banded from these three active colony sites in SD. All nestlings were banded with the regular federal band plus the yellow color leg band placed on the left leg of each one.

One of the most significant benefits resulting from this project has been the collaborative partnership established with such a prestigious team of scientists from York University in Toronto and PMCA in Erie, PA. South Dakota, through this project, became a part of this "team" effort studying Purple Martin migration patterns using direct tracking (geolocators) of individuals across their breeding range in North America to identify the most

important regions to focus protection for species conservation. According to these scientists, South Dakota is one of six other states representing seven breeding populations across the eastern subspecies range in North America involved in current migration research with geolocators. The data collected from the geolocators deployed on Purple Martins from SD is now being included in scientific papers being submitted by York University such as the recent paper accepted in the Proceedings of The Royal Society B, by Fraser et al, 2012 (see appendix 2). This paper documented a surprising result in that these seven different breeding populations separated by up to 1,243 miles shared a broad overwintering region in northern Brazil from the Rio Negro region eastward to the mouth of the Amazon River in South America (see Figure below-triangles for males and circles for females).



This core wintering region is dominated by largely undisturbed tropical rainforest with lesser percent agricultural ground cover which is opposite to their nesting and breeding summers in North America where they are largely dependent on manmade housing structures in an agricultural dominated landscape, like South Dakota. Individual Purple Martins from a distinct breeding colony population also had a broad distribution in the wintering grounds, suggesting that any future habitat changes to this wintering region would have an influence on population dynamics across the whole breeding range for Purple Martins in North America.

Another paper that York University has submitted and currently waiting for acceptance to one of the top journals on bird research is to "The AUK". The title of this paper is "Consistent Range-Wide Pattern in Fall Migration Strategy of Purple Martin (*Progne subis*), Despite Different Migration Routes at the Gulf of Mexico". In summary, this paper tells how the widely separated breeding colonies across the Purple Martin range with different departure dates and routes, and long fall migration journeys showed a strikingly similar fall migration strategy. Their fall migration showed a rapid initial migration covering 1,243 miles or more, followed by prolonged stopovers and a slower pace through Central America before continuing onto South America with a faster pace again to reach the wintering grounds. Purple Martins from the more western breeding populations (MN, SD, TX and OK) were much more likely to take a western route around the Gulf, whereas those populations (NJ, VA) nearer to the Atlantic coast, took a mostly overland route around the Gulf traversing the Florida pan-handle and crossing a shorter open water distance to Cuba. Purple Martins from PA directly north of the Gulf made a direct Gulf crossing to the Yucatan peninsula.

This small grant program project catapulted South Dakota into being a part of "state-of-the art" scientific research on Purple Martins as illustrated in these two prestigious journals. With these new research findings from not only from this project but also with the scientists from PMCA, York University, and the other states altogether, a foundation of knowledge has expanded and added to all the information on Purple Martin biology already assembled by PMCA which is now available to all individuals with an interest in Purple Martins.

A couple of other activities that will continue to be "ongoing" to inform and get more individuals involved with Purple Martins occurred when Paul was asked by Perry D. Vogel from North Dakota to assist him in forming an organization for Purple Martins in ND and SD. Perry and Paul became co-founders of the "Purple Martin Association of the Dakotas" to assist individuals in learning more about martins and assist them on being successful landlords. The association can be found at www.purplemartinassociationdakotas@weedy.com or on Facebook at www.facebook.com/PMAD2012. The PMCA has accepted this association as an affiliate and was registered as a non-profit organization on 7 March 2012. Another step, to inform individuals on Purple Martins was taken when Chris Hull, Staff Writer for SD GFP, came to the Columbia colony site to photograph and take video on this project activities. Plans are to expand and utilize the online media "outlets" through SD GFP to expose more people to the world of Purple Martins.

Acknowledgements

This project was made possible by funding approved through the SD GFP Wildlife Diversity Small Grants Program, whom we sincerely thank. We are also deeply indebted to Dr. Bridget Stutchbury at York University for donating the additional geolocator devices deployed during this project and for the analysis work to develop all the individual migration maps from the SD retrieved geolocators. We are very grateful to Kevin Fraser from York University to come to our colony sites to assist in training and deploying the "first-ever" geolocators on SD Purple Martins, and for his continued friendship throughout this project duration. He has done an outstanding job on writing and submitting two scientific papers on Purple Martin migration from all geolocators retrieved from all states involved. We would like to thank PMCA and especially John Tautin for their and his acceptance, direction, and support for individual Purple Martin landlords to be a part of Purple Martin conservation efforts, especially with geolocator research. We would like to thank Eileen Dowd Stukel for all her efforts on obtaining all necessary authorizations to the master banding permit, bands, and for her interest in Purple Martin geolocator research to be able to conduct this project. We also wish to thank Joy Mammenga, Luverne Mammenga, Tim Mammenga, Riley Mammenga, Kathy Hegge, Dan Nelson, and Chris Hull for their important contribution to complete the tasks of capturing, handling, and data recording to successfully deploy geolocators for this project.

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Appendix 1

PROJECT TITLE

Tracking Purple Martins from South Dakota with Geolocator Devices

PROJECT DESCRIPTION (Give a general overview of the project)

An astonishing news release was first reported on February 13, 2009 by The National Geographic Society, Dr. Bridget J. Stutchbury at York University (Science 2009), and the Purple Martin Conservation Association (PMCA Update 18(2) Spring 2009), documenting the long range migration of two Purple Martins (*Progne subis*) from PMCA's Edinbro, PA research colony to Brazil and back using innovative small tracking devices called geolocators. These geolocators were attached to 20 Purple Martins in 2007 with these two martins being the first ones recaptured upon arrival back to their nesting colony site in spring of 2008 (Stutchbury 2009). These "state-of-art" devices hold unbelievable promise for expanded learning on Purple Martins and other long range migratory species of songbirds. It is known that much of North America is the breeding range for Purple Martins, and that they over-winter in most of South America, especially Brazil, but very little is known about their journey between these continents.

Until now, there was no way to track small individual songbirds during migration from their breeding areas, to winter grounds, and back. These tiny data "backpacks" on these first two martins in 2008 revealed an amazing 4,500 mile migration journey to wintering grounds in Brazil, including a more than 500 mile trek over-water (Gulf of Mexico) flight (Stutchbury 2009). This news was contrary to what former researchers thought as a more leisurely path and time period for swallows migrating to their wintering grounds. Analysis of these two martin's spring time movements documented a much faster pace than to their wintering ground to get back to their breeding sites for selecting the best nesting sites and mate first (Stutchbury 2009). One bird was back at its nesting colony only two weeks after leaving its wintering site.

In 2008, a smaller type geolocator was developed in hopes of improving return rates with another 20 new devices attached to martins at PMCA's

research center in NW Pennsylvania resulting in only 3 martins with geolocators returning in 2009 (Tautin and Barrow 2010). Staff at PMCA continued to have concerns with lower than expected returns this second year with these devices. PMCA's decision to continue with research with geolocators was made after development of a newer type that was smaller in size and having a much shorter light sensor stalk. In 2009, 41 more geolocators were placed on adult martins with 21 in PA and 20 in Texas (Tautin and Barrow 2010). PMCA had an interest in comparing migratory paths from PA to martins nesting along the most southwestern boundary of their breeding range along the Texas coastal area near Corpus Christi.

Finally, the 2010 martin season arrived in Texas with 9 of these new type geolocators on martins were recovered from the 20 deployed in 2009 (Tautin and Barrow 2010). Back in PA, folks from the PMCA were ecstatic with a recovery of 11 martins with geolocators from the 21 deployed in 2009 (Tautin and Barrow 2010). This new style device resulted in close to a 50 % recovery rate (20 out of 41) on returning martins in 2010 (Tautin and Barrow 2010). This impressive recovery rate renewed a sense of confidence in this type of research utilizing geolocators on Purple Martins. With this renewed confidence in the effectiveness of geolocators, PMCA decided to continue with plans in 2010 with deployment of 41 more geolocators with 11 going to Texas and 20 to PA (Tautin and Barrow 2010). Also, PMCA decided to collaborate in 2010 with folks in Virginia to place 40 geolocators on martins in that State to see how coastal martins migrate (Tautin and Barrow 2010). The geolocator projects in Pennsylvania and Virginia will continue in 2011, and two new projects will begin in New Jersey and Minnesota.

It is with this sense of collaboration with other States and the willingness of PMCA and York University to form partnerships, brings this project proposal for consideration for funding deployment of geolocators on Purple Martins in South Dakota in 2011 also. South Dakota is located on the western edge of their breeding range and in the central area of North America. It is with this strong interest between all of us to form a partnership to learn about Purple Martin migration from this part of their breeding range compared to the other research findings from geolocators deployed so far.

PROJECT NEED (Why is the project needed and why is funding needed?)

John Tautin (2007) reported on population status, and the distribution and relative abundance of Purple Martins in North America as the USGS Breeding Bird Survey assessed. Looking at South Dakota, the trend population for Purple Martins account for long-term stability with very little percent change in population levels per year, but South Dakota is on the western edge of their breeding range with a low relative abundance. It is this rating of low relative abundance of Purple Martins in South Dakota which should be of conservation concern by landlords and Wildlife agencies and organizations in South Dakota. Tautin (2008) stated that recognizing problems with martin populations is one thing, but doing something about problems is another. One incident reported by Mammenga (2007) on a pre-migratory roost in Sioux Falls should be viewed as one of those needs for concern. Thousands of martins were viewed going to roost in 2005. Then in 2006 on a return visit to witness the roost again, a "heart-sickening" feeling came upon us (my brothers and I) to see most of the roosting trees cut down and the remaining trees thinned out to reduce canopies to discourage the martins from using them. The result of this action has caused this roost to be non-functioning ever since. Where have the roosting martins gone since? A new roosting site has not been located yet today. It is hoped from this project that a roost site could be located again, or to see where South Dakota martins are stopping in other pre-migratory roosts in other States. The other issue learned from this incident of losing martins from using this roost is that many people are very much misinformed about Purple Martins.

The need for funding this project through the small grant program of the Division of Wildlife, Department of Game, Fish and Parks will benefit continued research where moneys have become scarcer for organizations like PMCA to expand this type of research to States like South Dakota due to the current recession. Relying on the martin community (active landlords) to take care of martins might be satisfactory management where populations are doing well (Tautin 2008), but in other areas, the support of other parties such as wildlife agencies and nongovernmental organizations is needed to maintain populations. If these other parties show support for more geolocator deployment, PMCA and York University are very much willing to collaborate and establish partnerships with them, including South Dakota Game, Fish and Parks.

PROJECT OBJECTIVES (Describe the objectives to be accomplished)

As an interested and active landlord hosting nesting Purple Martins, establishing a unique partnership with PMCA, York University, and South Dakota Game, Fish and Parks would be rewarding and a benefit to martins in South Dakota. This partnership and collaboration would contribute and expand our knowledge on Purple Martin migration and dispersal from this area of their breeding range, and hopefully identify critical habitats both along their migratory path (migratory roosts) and in their winter range. Another objective would be to build a foundation of knowledge and understanding among South Dakota citizens on and for Purple Martins.

PROJECT METHODS (Describe the methods or techniques to be used to accomplish the objectives)

Establish and maintain a cooperative dialogue with PMCA, York University, and SD Game, Fish and Parks. Collaborate with PMCA to purchase at least the recommended minimum number (20) of geolocators for best return rate. Attend training session with PMCA to become proficient in proper technique in attaching geolocator devices onto adult Purple Martins. Modify up to 48 nesting gourds and nesting compartments on housing at my colony site in Sioux Falls and at my brother's colony site near Columbia in NE South Dakota to facilitate capturing sufficient numbers of adult martins to be fitted with geolocators devices. This modification would involve attachment of tunnel entrances to accommodate a trap door device. This preparatory work would be accomplished prior to martins return in April and May 2011. Monitor nesting season by doing nest checks to identify individual martins for capture and to know the proper time period for geolocator deployment with the highest probability of success and survival of martins. Assemble enough assistants to conduct capture of birds, provide proper bird handling, bird banding, geolocator attachment, and final deployment of martins with the devices. Proper documentation of records will also be addressed at this time. The minimum number of people needed at one time will be four which could include my brothers, father, SDOU members and Biologists from Game, Fish and Parks. Plans are to place or deploy one half of the number of geolocators at the Sioux Falls colony site with the remaining placed on martins at the Columbia colony site.

When Purple Martins begin to return to each colony site in the spring of 2012, many hours of observation time will be conducted to locate any martins returned with attached geolocators. Once a martin is observed and its compartment identified, set the trap door for that compartment to capture

the martin to remove the geolocator device. Continue with this activity until as many geolocators have or could be found. Keep all partners informed on this progress of recoveries. Ship all collected geolocators devices to PMCA or York University for data analysis. Once data analysis is completed, submit report on findings to SD Game, Fish and Parks.

EXPECTED RESULTS (Describe expected results and benefits. Must provide a product that is useable by the public)

Collaborate with PMCA and York University to obtain assembled data collected from the geolocators from the SD Purple Martins. Acquire information and maps on migration routes and winter areas. Assemble data to answer many of the questions that were not known before the project. Use this "foundation" information to inform other Purple Martin landlords and citizens of South Dakota through presentations, possible development of a martin festival similar to those from other States or groups, and establish a mentor program to assist current and new landlords in South Dakota with proper techniques to be more successful with an active martin colony. A huge product from this project could be to assemble a spot on the South Dakota Game, Fish and Parks website to share all this information to benefit the continuation of conservation of Purple Martins here in South Dakota. Encourage citizens to become a landlord for martins and to become a member of the Purple Martin Conservation Association where more detailed news on Purple Martins can be learned. A written report on this project in the SD Conservation Digest would be a positive product for all citizens who read this magazine.

QUALIFICATIONS OF APPLICANT(S) (Relate your qualifications to the project)

I have maintained an active nesting colony site at Sioux Falls for 9 years. The colony site hosted 70 plus nesting pairs in 2010. My brothers and Father will cooperate and assist in this project. My brother, Tim, lives down the street from me and has been an active landlord for 15 years. His colony site hosted 60 plus nesting pairs in 2010. My brother, Paul, has been an active landlord for 11 years near Columbia and hosted 41 nesting pairs in 2010. He has over 30 years' experience in capturing, handling, and banding many ducks and geese as a Biologist for the SD Game, Fish and Parks. He has participated in Martin Watch program with PMCA. His nesting results for this program have been accepted by PMCA for the last three years. My

Father, Luverne, has been an active landlord for 6 years and hosted 32 nesting pairs in 2010.

I will invite other Biologists from the Game, Fish and Parks to cooperate and assist, if they would like, especially during capture, banding, and attaching geolocators to adult martins in July, 2011.

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PROJECT TIMETABLE

Date	Milestones
April 2011	Project Starting Date

April 2011 Install tunnel entrances to gourd nesting compartments and get nesting colony structures ready before martins return

May – June 2011 Monitor nesting activity with regular nest checks

July – August 2011 Attend training in PA (July); band and deploy geolocators to martins at colony sites in Sioux Falls and Columbia

April – May 2012 Conduct observations at colony sites for returning martins with geolocators devices; recapture martins to remove geolocators and ship devices back to York University or PMCA for analysis

December 2012 Final Report Submitted

BUDGET

Show how the project is expected to be funded. The amount requested from the Wildlife Division Small Grants Program is limited to $5,000.00. If other funding sources are available for the project, give the amount and describe how that funding will be used. Donated time and/or expenses should be described briefly, also.

Personnel Expenses

Two nights lodging with meals in PA for training @ $120.00/day
$240.00

Travel Expenses

1 – Round trip airline ticket to Erie, PA for geolocator training
$650.00

Vehicle miles: To set-up colony sites; modify entrance w/traps and to capture martins at colony sites to deploy geolocators

devices at Columbia and Sioux Falls: @ $.32/mile x 800 miles
$256.00

Supplies

25 – Geolocator devices from PMCA @ $150.00 each
$3,750.00

48 – Troyer tunnel entrances with trap doors for gourd nesting compartments to assist in capturing martins
$320.00

Other

Total
$5,216.00

Other Funding Sources

If any sponsorship for geolocators is received, the moneys will be used to purchase additional geolocators from PMCA if available.

Donated Time/Expenses

All time and labor associated with modifying nesting compartments with entrance trap doors; deployment of geolocators on captured martins; observation time in spring of 2012 looking for martins at both colony sites with resulting recapture efforts to remove geolocator devices will all be donated. Just the number of estimated time to conduct the observations in 2012 could be over 140 hours with additional hours for recapture of martins with geolocators to retrieve the data devices. Estimated donated vehicle mileage to colony sites in spring of 2012 for observations and recapture martins with geolocators at 1,200 miles @ $.32/mile will be $384.00. Mailing of geolocator devices back to PMCA or York University will be donated expense also.

Total Requested from Wildlife Division,
Wildlife Diversity Small Grant Program
$5,000.000

Appendix 2

(see attachment for total paper)

PROCEEDINGS OF THE ROYAL SOCIETY B

Proc. R. Soc. B
doi:10.1098/rspb.2012.2207
Published online

Continent-wide tracking to determine migratory connectivity and tropical habitat associations of a declining aerial insectivore

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North American birds that feed on flying insects are experiencing steep population declines, particularly long-distance migratory populations in the northern breeding range. We determine, for the first time, the level of migratory connectivity across the range of a songbird using direct tracking of individuals, and test whether declining northern populations have higher exposure to agricultural landscapes at their non-breeding grounds in South America. We used light-level geolocators to track purple martins, *Progne subis*, originating from North American breeding populations, coast-to-coast ($n = 95$ individuals). We show that breeding populations of the eastern subspecies, *P. s. subis*, that are separated by *ca.* 2000 km, nevertheless have almost completely overlapping non-breeding ranges in Brazil. Most (76%) *P. s. subis* overwintered in northern Brazil near the Amazon River, not in the agricultural landscape of southern Brazil. Individual non-breeding sites had an average of 91 per cent forest and only 4 per cent agricultural ground cover within a 50 km radius, and birds originating from declining northern breeding populations were not more exposed to agricultural landscapes than stable southern breeding populations. Our results show that differences in wintering location and habitat do not explain recent trends in breeding population declines in this species, and instead northern populations may be constrained in their ability to respond to climate change.

Keywords: geolocator; songbird; South America

1. INTRODUCTION

Population dynamics of neotropical migratory songbirds are driven by the interaction of productivity on the breeding grounds and mortality, which occurs primarily during migration and the non-breeding season in the tropics [1–3]. Migratory birds are predicted to be more vulnerable to habitat disturbance and environmental change at their wintering grounds if they exhibit strong migratory connectivity, in which most members of a given breeding population migrate to the same region within the non-breeding range [4,5]. In contrast, species with weak migratory connectivity are buffered from habitat disturbance in specific non-breeding regions because reduced survival of individuals is spread diffusely across the breeding range [6]. However, understanding the population dynamics of long-distance migratory songbirds has been hampered by the difficulty in determining migratory connectivity [2,6] because until recently it was not possible to track migration of songbirds [7].

Connectivity patterns between breeding and wintering sites thousands of kilometres apart have been determined for migratory songbirds using large-scale band-recovery efforts [8–10], but for many species recovery records

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