The Effects of New Housing Structures Within an Established Purple Martin Breeding Colony

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Abstract

With the long history of interactions between humans and Purple Martins, Martins have developed a dependence on human management for nesting sites, and thus, continuation of their populations. Houses with nest boxes are raised across North America to support the breeding habits of Purple Martins. Though important for the birds, it can be challenging to attract Purple Martins to new nest houses. This paper shows the results of a study to monitor the relationship of Purple Martins with two new nest houses in an established nesting site. The results show that the new boxes have lower occupancy rates (42%:92%) and a higher proportion of nesting subadult birds (44%:4% respectively) compared to the old boxes. The average clutch sizes for subadult birds were found to be smaller than the adult birds (4.0:5.2 respectively). Aligning with this information, the average clutch size of the new houses was found to be similarly smaller than in the already established houses (4.4:5.1 respectively).

Introduction

The Beaverhill Bird Observatory is currently home to 4 colony houses intended for the use of Purple Martins. Beginning with only one house in 2014, the site has seen increased success of Purple Martins since 2020 when the old house was replaced with 2 new houses. Two more new houses were added in May of this year. Purple Martins rely heavily on human intervention in their breeding habits. Historically, Purple Martins nested within naturally forming tree holes. The reliance on humans began when Indigenous Peoples would leave gourds hanging in trees for the Purple Martins to nest in (Stokes et al. 1997). With this practice continuing and increasing over time the Purple Martins have adapted to

prefer human-built nests. Today, Purple Martins prefer to nest within proximity to human-made structures, and the number of Purple Martins occupying nest boxes increases within 30m of human structures. (Jackson Tate 1974). On average Purple Martins have higher nest success rates when human intervention occurs during the nestling stage (Raleigh et al. 2019). When managed by people, Purple Martins can be protected from more aggressive invasive species such as house sparrows and European starlings. Lack of management leads to increased competition for nest sites, which may be a primary factor for declines in Purple Martin populations (Raleigh et al. 2019).

Purple Martins exhibit sexual dimorphism, where the adult male birds can be identified by their dark-coloured bodies, while the females display a white belly with brown markings along the chest and tail. To differentiate between adult and subadult Purple Martins, the subadult males have a light-coloured stomach with batches of dark colouring. At the same time, the subadult females look more similar to the adult females but with fewer brown markings. Not only do these birds differ between sex and age, but they exhibit different behaviours when migrating. The adult Purple Martins on average arrive earlier than the subadult birds with adults often arriving between April 25-May 3rd while subadults often arrive between May 15 into early June (Morton Derrickson 1990). Many of the adult birds may have already returned to their original houses before the new houses were installed.

Purple Martins will often return to areas within 50km of their nesting sites (Cook et al. 2021). This can make the establishment of new colonies difficult. Having the new houses added to an established nesting area will increase the chances of the new houses becoming occupied. On average, subadult parents have smaller clutch sizes than adult parents with subadults having an average of around 4 eggs and adults having an average of around 5 eggs. (Brown 1978). Due to this I predict that the subadult nests found within this site will also have smaller average clutch sizes while the adult birds will have on average a larger clutch size in comparison. With subadults migrating later than adult birds, I predict the two new houses will have a higher rate of subadult birds nesting than in the two original boxes. As the new houses have not been previously established as successful nesting sites paired with the late

installation, missing the adult return date, I predict the new houses will have fewer nests in comparison to the older houses.

Methods

This study was conducted within the Beaverhill Natural Area where 4 Purple Martin colonies were observed, each containing 12 nest compartments. General maintenance and cleaning of the houses were done prior to the monitoring, and the two new boxes were installed on May 15, 2024. The first nest check occurred on May 12, 2024, with weekly checks beginning on May 21, 2024, typically occurring on Wednesday mornings.

With the addition of two new nest boxes added this year this study explores Purple Martin's use of new boxes compared to old boxes within an established nesting area. The checks were started by observing the birds entering and leaving the nest boxes from outside. Sex and age of the parents was determined by observing the birds that frequented the houses. The birds were identified as subadult male (SAM), subadult female (SAF), adult male (AM), adult female (AF), and female (F) if it was difficult to determine age. Next, the colony houses were lowered to check the nests. The development stage of the nest was recorded as either no nest, partially built, completed without lining, or completed and lined with leaves. When applicable, the number of eggs, chicks, and age of chicks was also recorded. To determine the age of the parent birds both observations taken from watching the bird interactions with nests as well as clutch sizes were used as subadults on average have smaller clutch sizes. If only clutch size was known to determine age, the nest was not used to calculate age specific results. If only one parent was observed at the nest the parental age was determined based on the observed bird and was used for calculating results. Nest checks were completed when the birds were around 22 days old when they began to fledge to avoid disturbances that can cause early fledging.

The data were analyzed using a t-test to compare the adult and subadult clutch sizes. Another t-test was conducted to compare the clutch sizes of houses PA and PB to houses PC and PD. Observational

data taken from watching the birds' interactions with the houses was also used to determine the age of the parents.

Results

The data were collected from 4 Purple Martin houses, each containing 12 nest boxes. Houses PA and PB were previously established nesting sites in May 2020, while houses PC and PD were added on May 15, 2024. Houses PA and PB had much higher occupancy rates than houses PC and PD. Both houses PA and PB had occupancy rates of 92% with 11/12 boxes filled in each, while house PC had an occupancy rate of 33% with 4/12 boxes, and house PD had an occupancy rate of 50% with 6/12 boxes filled.

Houses PA and PB were also found to have fewer subadult bird activity compared to houses PC and PD. House PA had 0% of nests occupied by subadults, PB had 9% of nests occupied by subadults, PC had 50% of nests occupied by subadults, while PD had 50% of nests occupied by subadults. Eighty-two percent of the eggs hatched with 98% of those hatchlings fledging. Eighty-seven percent of the total nests were considered successful with at least one chick that fledged. Subadult nests were 67% successful while adult nests were 92% successful. Houses PA and PB were 90% successful while houses PC and PD were 89% successful.

A difference between the clutch sizes of adults and subadults was found. The adult average clutch size was 5.2±1.2 while the subadult average clutch size was 4±0.5. The clutch sizes within houses PA and PB most closely reflect the average clutch size of the adult clutches with an average clutch size of 5.1±1.1. The average clutch size within boxes PC and PD most closely reflects the size of subadult nests with an average clutch size of 4.4±0.5.

Figure 1: The age, clutch size, date of eggs laid, and hatch date for the breeding pairs of Purple Martins in the houses PA and PB, located at the Beaverhill Bird Observatory in 2024.

House #	Age	Clutch Size	Eggs Laid	Hatch Date
PA1	Adult	4	26-Jun	14-Jul
PA2	Adult	6	19-Jun	unhatched
PA3	Adult	6	19-Jun	10-Jul
PA4	Adult	6	19-Jun	4-Jul
PA5	Adult	4	19-Jun	10-Jul
PA6	Adult	6	12-Jun	1-Jul
PA7	Adult	4	19-Jun	5-Jul
PA8	Adult	6	12-Jun	3-Jul
PA10	Adult	4	12-Jun	3-Jul
PA11	Adult	6	19-Jun	10-Jul
PA12	Adult	5	12-Jun	3-Jul
PB1	Adult	5	19-Jun	7-Jul
PB2	Subadult	3	19-Jun	unhatched
PB3	Adult	7	12-Jun	5-Jul
PB4	Adult	5	26-Jun	14-Jul
PB6	Adult	5	19-Jun	8-Jul
PB7	Adult	4	26-Jun	17-Jul
PB8	Adult	5	26-Jun	unhatched
PB9	Adult	6	26-Jun	14-Jul
PB10	Adult	5	19-Jun	4-Jul
PB11	Adult	4	19-Jun	10-Jul
PB12	Adult	6	19-Jun	3-Jul

Figure 2: The age, clutch size, date of eggs laid, and hatch date for the breeding pairs of Purple Martins in the houses PC and PD, located at the Beaverhill Bird Observatory in 2024.

House #	Age	Clutch Size	Eggs Laid	Hatch Date
PC2	Adult	6	12-Jun	13-Jul
PC6	Subadult	4	26-Jun	unhatched
PC 8	Subadult	4	19-Jun	5-Jul
PC 11	Adult	5	26-Jun	14-Jul
PD1	Adult	4	19-Jun	8-Jul
PD2	Adult	4	19-Jun	8-Jul
PD6	Subadult	4	19-Jun	10-Jul
PD9	Subadult	4	3-Jul	16-Jul
PD12	Subadult	5	19-Jun	10-Jul

Figure 3: The average clutch sizes of adult and subadult Purple Martins. With error bars displaying the variance. Data were collected at the Beaverhill Bird Observatory in 2024.

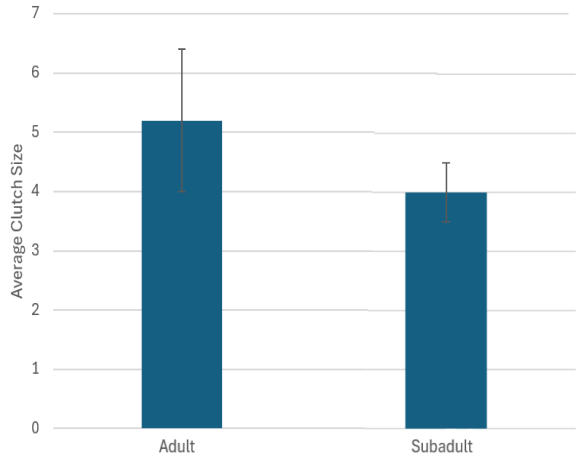
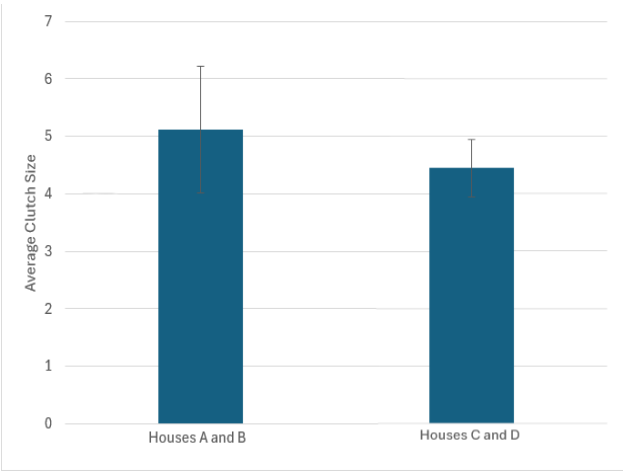


Figure 4: The average clutch sizes of houses PA and PB compared to houses PC and PD. With error bars displaying the variance. Data were collected at the Beaverhill Bird Observatory in 2024.



	Adult Clutch	*Subadult Clutch*
Mean	5.2	4
Variance	1.2	0.5
Observations	5	5
Pearson Correlation	0	
Hypothesized Mean Diffe	0	
df	4	
t Stat	2.05798302	
P(T<=t) one-tail	0.05435048	
t Critical one-tail	2.13184679	
P(T<=t) two-tail	0.10870095	
t Critical two-tail	2.77644511	

Figure 5: Results of the t-test comparing the adult and subadult clutch sizes of Purples Martins. Data were collected at the Beaverhill Bird Observatory in 2024.

Blowfly Larvae

Blowfly larvae can pose a great threat to the lives of developing chicks. Removal of these parasites is an important part of the management of Purple Martin nests to reduce harm done to the chicks. Throughout the course of this study, many nests were found with these parasitic larvae. In cases with a small number of larvae the individual larvae were removed from the nest. In nests with many

blowfly larvae a full nest change was conducted where the old nest material is removed, and fresh nest material of grass and leaves was added. Any larva found feeding on the chicks was removed by hand.

Discussion

It appears that within established breeding areas for Purple Martins, the introduction of new housing impacts the distribution of Purple Martins within the nesting area. The previously established houses had a far higher occupation rate. Being up longer some Martins may have imprinted on these houses in previous years. The houses were also available earlier meaning they were available to the adult birds who arrived from migration before the new houses were added. The new houses were added later in the year, which likely impacted the number of adult birds observed nesting. Subadult Purple Martins arrive later than the adult birds. Many of the adult birds would have already established their territories within houses PA and PB leaving more opportunities for the late arriving subadults to claim territory within houses PC and PD. The lower occupation rates for houses PC and PD would also reduce competition for nesting sites, allowing more subadults to claim a box.

The average clutch size of the adult birds within the houses was found to be 5.2±1.2, while the subadult average clutch size was found to be 4±0.5. Based on this information, we can expect that subadult birds will often lay fewer eggs than adult Purple Martins. Other studies have found similar results of adult females having larger clutches than subadult females where adult females had 5.23± .11 eggs and subadult females lay 4.39± .18 eggs in Tennessee. (Eads 2001) Within houses PA and PB, nests had an average clutch size of 5.1±1.1. This aligns most closely with the average adult clutch size. Using both the observational data of the number of adults spotted at houses PA and PB alongside the average clutch size data, houses PA and PB are primarily used by adult Purple Martins. The average clutch size within the newly added houses PC and PD was 4.4±0.5. This data aligns closely with the subadult average clutch size. With both the observational data and average clutch size, houses PC and PD have a higher rate of subadult nests.

This study was limited by the difficulty of data collection through observational data collection. The age of Purple Martin parents was determined primarily through observing their interactions with the nest boxes. Data collected through this method may have been incomplete as some parents may not have been present during the observation times. In some cases, some nests could have been mixed age but only one parent was observed at the nest which could have impacted results. The date the new houses were installed is another factor that may have impacted the results. The new houses were installed after many of the adult birds had already migrated and began to claim territories. Had these boxes been installed earlier the demographics of adult and subadult parents at these boxes could have been different.

Future research should be focused on the demographics of the new houses compared to the pre-established nest houses. Over time the new houses should see an increase in the Purple Martin using them as the houses become more established. The demographics, number of Martins, and number of returning banded birds could be a focus of future research.

Conclusion

It was hypothesized that the introduction of new nest houses within an established Purple Martin breeding site would influence the distribution of Purple Martins based on age and occupation rates of housing. It was also predicted that the clutch sizes would differ between the new housing and old housing. It was determined that the new houses had a higher rate of subadult birds likely due to less competition with adults. The higher rate of subadults was associated with the lower average clutch size and observational data. This distribution was likely due to the late installation of the new housing resulting in less competition with adult birds. Understanding how Purple Martins interact with new housing structures can be important for providing adequate management of the species.

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Bibliography

Brown CR. 1978. Clutch size and reproductive success of adult and subadult Purple Martins. Southwest Naturalist. 23, 597-604.

Cook C, Hvenegaard G, Holroyd G, Pletz H, Pearman M. 2021. Age and Sex Influence Natal and Breeding Dispersal of Purple Martins. Western Birds. 52(1), 296-310.

Eads J. 2001. The Effects of Parental Age and Housing Type on the Reproductive Success of the Purple Martin (Progne subis). Faculty of the Department of Biology. East Tennessee State University.

Jackson JA, Tate J Jr. 1974. An analysis of nest box use by Purple Martins, House Sparrows, and Starlings in eastern North America. Wilson Bull. 86, 435-49.

Morton ES, Derrickson KC. 1990. The biological significance of age-specific return schedules in breeding Purple Martins. Condor 92, 1040-50.

Raleigh D, Ray D, Grisham A, Siegrist J, Greene U. 2019. Nest survival data confirm managed housing is an important component to the conservation of the eastern purple martin. Wildlife Society Bulletin. 43(1), 93-101. https://doi.org/10.1002/wsb.941

Stokes D, Stokes L, Brown J. 1997. Stokes Purple Martin book: The Complete Guide to Attracting and Housing Purple Martins. Little, Brown and Company.

Photos of Purple Martins in 2024, clockwise from top lef:, female martin, a busy nest box, view from the ground and a male martin