

DEMOGRAPHICS OF AN ESTABLISHING PURPLE MARTIN COLONY NEAR EDENWOLD, SK (2018-2021)

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Introduction

The Purple Martin (*Progne subis*; hereafter martin) is North America's largest swallow species and are a fairly common summer resident across the southern half of Saskatchewan.^{1,2} Martins nest in secondary cavities, such as those made by a woodpecker, and do not create their own nesting cavity. Interestingly, martins east of the Rocky Mountains now rely almost exclusively on human-made cavities in the form of Purple Martin "condos" or gourds.² Continued access to quality nesting structures is important for the species to thrive. However, population trends across North America from Breeding Bird Surveys (BBS) show a 33 per cent population decline in martins, from an estimated 13 million birds in the 1970s to 8.7 million today, with these declines being most pronounced in eastern North America.^{3,4} The causes for this widespread population decline are unclear, but severe weather events amplified by climate change, introduced species such as House Sparrows (*Passer domesticus*) and European Starlings (*Sturnus vulgaris*) that compete with martins for nest cavities, and pesticides such as neonicotinoids are believed to all play a role.¹ However, it is thought that there are currently more available cavities through human-provided housing than ever before.¹ Interestingly, BBS data from Saskatchewan depict the reverse

population trend, where martins have been increasing by 3.55 per cent per year in the Prairie Pothole region and 6.96 per cent per year in the Prairie Taiga Plains since the 1970s.⁵ Perhaps an increase in suitable nest sites with the installation of human-provided cavities on the previously treeless prairies has spurred this growth, as increasing trends are the case in Alberta province-wide and in the Manitoba Pothole region.⁵

Through research, education and networking, groups such as the Purple Martin Conservation Association (PMCA) work closely with martin "landlords" to help monitor and provide nesting habitat for martins.⁶ The PMCA encourages landlords to regularly monitor the nest contents of each cavity throughout the breeding season and submit these data for continent-wide analysis by the PMCA.

Here I present four years of colony monitoring data from an establishing Purple Martin colony in southern Saskatchewan.

Methods

Study Site

The Saw-whet Purple Martin colony is located at the Saw-whet Acres Research Station near Edenwold, Saskatchewan (50° 39' 31" N, 104° 17' 58" W). The station is situated on the southern edge of the Aspen Parkland eco-region and is surrounded by cropland and tame pastureland, with numerous small wetlands and one small lake 500 m north of the yard. The small lake is roughly 1 km by 1 km in size. The yard site is treed with large spruce trees (*Picea* sp.), hybrid poplars

(*Populus* sp.) and Trembling Aspen (*Populus tremuloides*).

Colony Management

From 2010 to 2017, two aluminum Trio Grandpa Purple Martin houses, each with 12 nesting cavities, were present in the yard site and between three and six pairs used the two houses annually. A concerted effort to attract a larger colony of martins began in 2018. In 2018, there were 28 cavities available, which included the addition of a 16-gourd rack with 16 plastic Troyer Horizontal Gourds and the two existing aluminum houses. However, I modified the two aluminum houses from 12 cavities each to six so that a pair had access to two cavities (I blocked off six entrance holes and connected the two cavities to give the birds more room). In 2019, the total number of available cavities grew to 34 as I added six large natural gourds to the colony on an additional pole system. Lastly, in 2020, I installed a new T14 wooden house with 14 cavities and another gourd rack with 12 plastic Troyer Vertical Gourds. I discontinued the use of the original Trio Grandpa houses and installed four of the six natural gourds below the T14 house, for a total of 46 available cavities in the colony. The 2021 configuration was unchanged from 2020. Figure 1 shows the different houses and gourds.

All housing units were on metal or wood poles approximately 5 to 6 m above ground and each of the racks or houses could be lowered and raised by a pulley system. The poles were spaced between 6 and 17 m apart from each other and the closest

poles were 8 and 12 m from an active house. Additionally, all gourds had screw-off lids, making it possible to inspect the contents; the aluminum and wooden houses could be easily opened as well.

Predator guards at the base of the poles prevented ground predators such as raccoons (*Procyon lotor*) from climbing the poles. Prefabricated

raptor guards were installed on the plastic gourds and the T14 housing had metal guards attached to prevent access by owls and hawks, but not the natural gourds. The gourd raptor guards were installed hastily in 2020 when a Great Horned Owl nest (*Bubo virginianus*) was found only 30 m from the colony. The aluminum housing did not have raptor guards.

Non-native nest-competitive species were also managed at the colony as it has been demonstrated these species are able to outcompete martins for cavities, thereby reducing martin nesting success.⁷ House Sparrows and European Starlings were dissuaded or eliminated from the colony by using nest removal, trapping and shooting.



FIGURE 1: Top left - Trio Grandpa Aluminum House. Top right - T14 Wooden house. Bottom Right – Natural Gourds rack. Bottom Centre - Troyer Horizontal Plastic Gourds, 16 rack. Bottom Left – Troyer Vertical Gourds with raptor guards.

Nest monitoring

Generally, nest checking began for the nesting season when martins were observed entering the housing with green leaves. From that point, all housing was lowered every three-to-seven days, depending on nesting stage, and each cavity was examined for nest construction, eggs, or chicks. Clutch initiation dates and hatch days were also calculated and recorded. Nest checks followed the guidelines set by the Purple Martin Conservation Association Project NestWatch program.⁸ A nest was deemed occupied if eggs were present. A nest was deemed fledged if the nestlings were absent after 27 days.

Adults were aged based on plumage characteristics by viewing them through binoculars or a spotting scope and the ages of the pair were recorded for each cavity.⁹ Birds were aged as either After-Second Year (ASY; which are two years old or older), Second-Year (SY; one-year old birds) or the age was not identified and recorded as Unknown.

Results

From 2018 to 2021, a total of 124 nests were initiated at the Saw-whet colony. Occupancy grew from 11 active nests (39%) in 2018 to 44 active nests (96%) in 2021, as the number of available cavities grew (Table 1). During the same period, the proportion of known SY birds decreased from 45% in 2018 to 6% in 2021 (Table 2).

The first day of egg laying for each clutch varied considerably over

YEAR	AVAILABLE CAVITIES	CAVITIES OCCUPIED	% OCCUPIED
2018	28	11	39%
2019	34	26	76%
2020	46	43	94%
2021	46	44	96%

TABLE 1. The number of cavities available and occupied by Purple Martins at the Saw-whet colony, near Edenwold, SK, 2018 - 2021. Occupancy was defined by eggs being laid in a cavity.

the four years, ranging over 35 days (Figure 2). The first egg of the year was laid on 31 May in both 2018 and 2019, 25 May in 2020 and 4 June in 2021. The late date for 2021 was likely due to a cold snap with freezing rain in late May. The latest egg laying began on 4 July in 2018 and 2020, 1 July in 2019, and 29 June in 2021. ASY females tended to nest earlier than SY females (Figure 2). Over all four years, the mean date of the first egg laid of each clutch was 11 June (Julian date = 162).

In total, 653 eggs were laid at the colony between 2018 and 2021 (Table 3). The mean number of eggs per nest varied between 5.0 and 5.4 per year (Figure 3). Hatch rate over the four years was 87.1% (n=567), with yearly hatch rates ranging between 77.5% and 92.7%, with 2019 being the lowest (Table 3). The mean number of chicks that hatched per nest each year was constant at 4.6 or 4.7,

except in 2019 when it dropped to 4.1 (Figure 3). Thirty-nine chicks (6.7%) that hatched died before reaching fledging age, while 532 chicks survived to fledge (94.1%; Table 3). The percentage of chicks that fledged from those that hatched varied per year from 92.2% to 96.1% (Table 3) and the mean number of fledglings per nest ranged between 3.8 and 4.5 (Figure 3). The overall percentage of fledglings from eggs laid was 82%, but annually varied from 71.8% to 89.1% (Table 3).

Clutch size ranged from two to seven eggs. Out of 124 nests, one nest contained two eggs (0.8%), one nest contained three eggs (0.8%), 17 nests contained four eggs (13.7%), 56 nests contained five eggs (45.2%), 44 nests contained six eggs (35.5%), and five nests contained seven eggs (4.0%). Two of the clutches that contained seven eggs fledged all seven chicks, both in 2020.

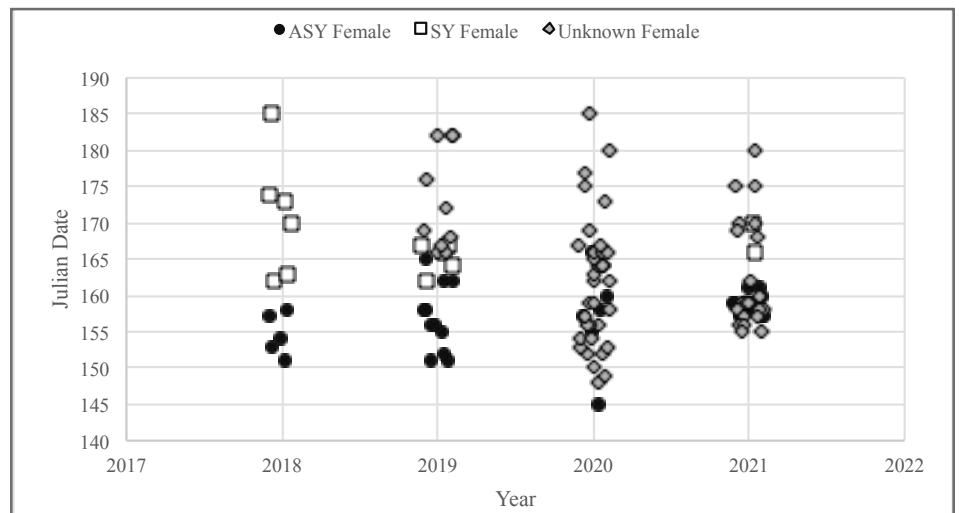


FIGURE 2: Known dates of the first eggs laid by adult female Purple Martins at the Saw-whet colony, near Edenwold, SK, 2018 - 2021. ASY females (2-year old birds or older) are shown as black circles. SY females (1-year old birds) are shown as white squares. Unknown age females are shown as gray diamonds. A Julian Date of 150 is 30 May, 160 is 9 June, 170 is 19 June, 180 is 29 June.

YEAR	ASY (N)	SY (N)	UNKNOWN (N)	TOTAL BREEDING ADULTS
2018	50% (11)	45% (10)	5% (1)	22
2019	44% (24)	22% (12)	33% (18)	54
2020	24% (21)	2% (2)	73% (63)	86
2021	57% (50)	6% (5)	38% (33)	88

TABLE 2. Percentage breakdown of age of adult Purple Martins at the Saw-whet colony, near Edenwold, SK, 2018 - 2021. ASY is After-Second Year (i.e., a two-year-old bird or older), SY is Second-Year (i.e., a one-year-old bird), Unknown Age (i.e., age of bird was not determined).

Discussion

The quick establishment of the Saw-whet colony to almost full occupancy at 43 and 44 pairs in just three years was surprising but consistent with other colony establishments that are managed similarly.^{2,10} Undoubtedly it helped that pairs of martins were already nesting in the Trio Grandpa houses prior to 2018, so some birds were already aware of the presence of nesting sites. There is also an existing colony in Edenwold 4 km SE of the Saw-whet colony that may have helped in attracting birds to the area.

Over the four years the martins at the Saw-whet colony showed considerable range in clutch initiation, from 25 May to 4 June (Figure 2). In 2021, egg-laying may have been delayed by a late-May freezing rain event, versus the apparent ideal nesting conditions in May 2020. Purple Martins are known to adjust their egg-laying based on local temperature conditions.¹¹ When they lay eggs earlier, martins fledged more young.¹¹

Generally, a new nesting site is colonized by SY birds in the early years of a colonies establishment, and then in later years ASY birds will dominate once the colony reaches full capacity or its maximum carrying capacity.⁶ ASY birds begin to arrive back in Saskatchewan in mid-April, while SY birds do not start to return until mid-May, a full month later (Jared B. Clarke *unpublished*

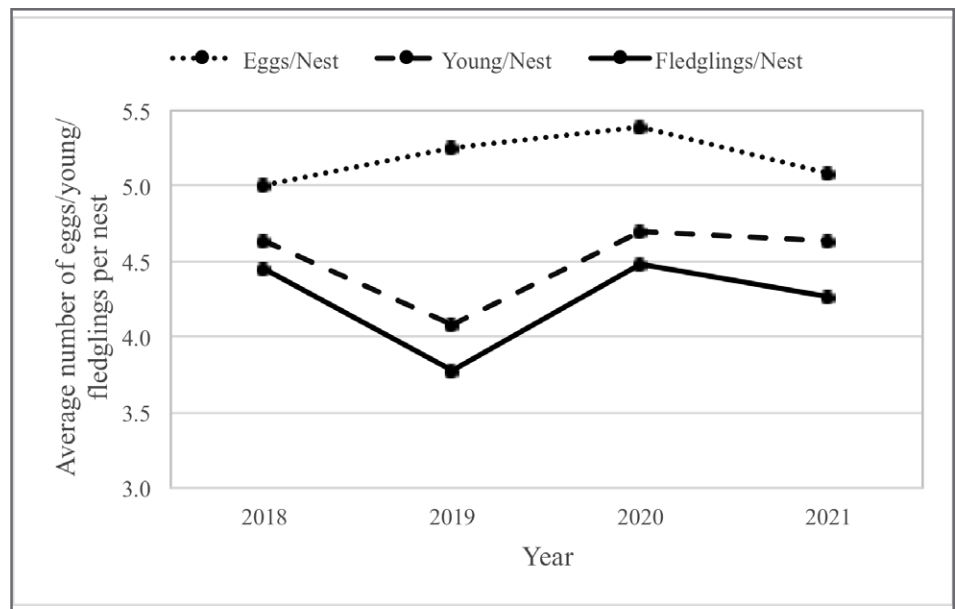


FIGURE 3: The mean number of Purple Martin eggs, young and fledglings at the Saw-whet colony, near Edenwold, SK, 2018 - 2021.

data).^{1,6} Therefore, older birds are able to claim cavities long before SY birds can. Table 1 shows that the proportion of SY birds decreased over the four years, although the relatively high number of unknown aged birds in 2019 to 2021 do not allow for a robust conclusion. ASY males and SY males are easy to distinguish based on plumages and territorial behaviours. The subtle differences between the female plumages proved to be more difficult to confirm. However, a clear pattern to support that more ASY birds were present in 2021, compared to 2019 and 2020, is seen in the timing of egg laying in Figure 2. Because SY females arrive at least one month behind ASY females, they will be delayed in pair bonding, nest building and then egg laying.

Some ASY females who do not have an ASY mate may be delayed too, as they wait for an SY male to arrive. However, Figure 2 shows a clear distinction between known ASY females who began laying eggs earlier than known SY females in 2018, 2019 and 2021. In 2021, 33 of the 44 nests are tightly clustered around the known ASY females' egg laying time. This contrasts to the 2020 data, where the middle cluster of nests between Julian date 162 and 170 could be made up of many SY birds.

The annual mean clutch sizes of between 5.0 and 5.4 eggs per clutch is consistent with other documented clutch sizes across the prairies in the northern limits of the martin's range. In Edmonton, AB, an average clutch size of 4.8 eggs per nest out of 55 nests over two years was reported for 1965 and 1966, while near Saskatoon, SK an average clutch size of 5.1 eggs per nest from 89 nests was reported in 2012.^{2,12}

Two clutches of five eggs and one clutch of six eggs failed to hatch in 2019 (Figure 3), which reduced the hatch rate for that year. These clutch failures may have resulted from the loss of one of the adult martins within

YEAR	EGGS	YOUNG	FLEDGED	% HATCHED	EGG TO FLEDGE %	HATCHLINGS TO FLEDGE %
2018	55	51	49	92.7%	89.1%	96.1%
2019	142	110	102	77.5%	71.8%	92.7%
2020	232	202	193	87.1%	83.2%	95.5%
2021	224	204	188	91.1%	83.9%	92.2%
Total	653	567	532			
Average				87.1%	82.0%	94.1%

TABLE 3. The total number of eggs, young and fledglings from the Saw-whet colony each year, near Edenwold, SK, 2018 - 2021. Additionally, the percentage of eggs that hatched, fledged, and the percentage of hatchlings that fledged.



Clutches with seven eggs are rare but occurred in 4% of the nests at the Saw-whet colony between 2018 and 2021. Photo taken on 8 June 2019.



It's hatch day in this cavity, with four chicks having already hatched, one egg pipping, and the other egg still not hatched. Notice the beautifully lined nest with green leaves, which is typical of Purple Martins in this area. Photo taken on 22 June 2019.



At only seven days old, these five nestlings' eyes are not even open yet! Photo taken on 2 July 2020.



These three nestlings, who are approximately 25 days old, may leave the nest in just a few more days from their T14 cavity. Photo taken on 8 July 2020.

the breeding pairs, possibly from an aerial predator such as a Cooper's Hawk (*Accipiter cooperii*) or Merlin (*Falco columbarius*). Cooper's Hawks were documented nesting within 50 m of the colony in 2018 and were regularly seen in the yard in 2019 and 2020. In one observation, at dusk on 20 May 2020, an adult Cooper's Hawk successfully grabbed a roosting adult martin off the T14. Any females depredated while incubating would result in a clutch failure and therefore reduce hatch rates, although above observed predation was prior to nest laying in 2020. The PMCA's 25-year hatch-rate average (1995-2019) for the Great Plains region is 4.05 per nest which is still lower than all four years at the Saw-whet colony, including 2019.¹³

It is surprising that the fledgling rate in 2021 was not lower, given the extreme drought conditions faced in southern Saskatchewan that summer.^{14,15} This suggests that the adult martins were able to find enough prey to feed to the nestlings; however, the fledglings' body condition could have been poorer than in past years. Most of the small, shallow wetlands around the colony were dry in 2021, but the large lake 500 m north of the colony and a large wetland within 50 m of the colony still contained water and therefore suitable habitat for the martins' insect prey. If these two bodies of water were to dry up, it could be disastrous for the birds' productivity.

Overall, productivity at the Saw-whet colony has been high over the last four years, as it has grown to full capacity in just three years. As a result of the predator guards, elimination of non-native nest competitors and close monitoring of nests, many pressures are removed for breeding martins at this colony and the data and results presented here represent a highly managed Purple Martin colony.

Acknowledgements

In the summer of 2017, while visiting Colette and Richard Stushnoff's farm to band hummingbirds, I was in awe of their full Purple Martin colony with 32 pairs! Listening to the clamorous chatter of these beautiful swallows as they soared and dove through the air, I was immediately drawn into their spell. This was where my love of the Purple Martin really started and I am forever grateful to Colette and Richard for setting me on this path. Thank you for your mentorship in establishing a colony of these amazing birds.

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