Historical success rate of House Wrens (*Troglodytes aedons*) at the Beaverhill Natural Area

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September 23, 2019

INTRODUCTION

House wrens (*Troglodytes aedon)* are a small migratory songbird species whose home range extends across Canada and into the southern parts of the United States and Mexico depending on the season. These small birds are recognizable by their brown-barred plumage with faint highlights of red across the wing and tail feathers, stubby bodies, and lack of distinctive black markings around the eyebrow region as seen in other Wren species (Godfrey, 1976). House wrens (HOWR) nest in areas dominated by deciduous trees and thick shrubs, preferring to nest in cavity structures such as the holes in trees or bird boxes. Nest structures are primarily made up of twigs with feathers, grasses, and hair as softer lining materials. The male HOWR arrive on the breeding grounds earlier in the season to stake out a suitable nesting area. Once the females arrive later in the season, the males begin the process of courting the females (Kaluthota & Rendall, 2017). HOWR do not mate for life and it has been observed that females may have multiple clutches in a single season with different male partners, and males may also be polygamous with multiple nesting females throughout the breeding season (Godrey, 1976). Eggs of the HOWR are distinguishable from other bird species because of their pink base colour and clear speckling pattern, which can be compared to the competing species of Tree Swallows (*Tachycineta bicolor)* with solid pale pink eggs.

Within the home range of the HOWR lies the Beaverhill Bird Observatory (BBO) a recognized area of importance for approximately 270 species including those that are migratory and native to the province. The Beaverhill Natural Area is located east of Tofield Alberta and encompasses two important bodies of water central to the large bird diversity. Beaverhill Lake, once estimated at 139km^2 and 3m deep in the 1980’s is now dramatically reduced in size and, Lister Lake, still a large and active body of water (http://beaverhillbirds.com/welcome/beaverhill-lake). Although these bodies of water have experienced changes in water volume over the years, they still play an important role in housing different species of birds in the natural area. Banding programs at the BBO during spring and fall migration closely monitor the species as part of the Canadian Migration Monitoring Network (CMMN) and Monitoring Avian Productivity and Survivorship program, commonly referred to as MAPS, which provide data that contributes to long-term analysis and monitoring (http://beaverhillbirds.com/welcome/about-bbo/).

Annually, student interns are hired to conduct HOWR surveys where they observe the nesting behaviour, clutch size, number of hatchlings, and fledge success for HOWR in different areas of the BBO. For the 2019 season Emily Jamieson and myself were responsible for monitoring 99 HOWR nests divided into four transects in different areas of the natural areas. This paper will discuss the data collected from the 2019 season and compare it to previous years to determine if there is a mean difference in the nest success between the different transects.

METHODS

Surveys were conducted weekly between May 19 and August 14, 2019 with weekly visits out to the nest boxes with an exception between July 10-22 and July 22-August 6 where rainfall had caused water levels between Beaverhill Lake and Lister Lake to rise making the weir impassible. Nests were monitored until the nestlings reached 11 days old, at which point the nests were left alone to reduce the risk of prematurely fledging and not checked until the 25-day mark.

Nestlings were aged using an aging guide from Brown et al. (2013), in most cases photos were taken of nestlings to reduce the amount of exposure without the lid of the nest box on, so that proper aging could be done later. Information collected from the nests included: build status of the nest (partial to full), number of eggs laid, number and age of the nestlings, and whether the parent(s) were present at time of check.

The survey sections for transects A, C, and D were setup in a 5x5 grid pattern, while transect B was setup in a 3x8 grid; in total 99 nests were monitored. Emily Jamieson conducted surveys in transect A and B, while I conducted surveys in transect C and D. Using the data collected from the two interns a single factor analysis of variance (ANOVA) without replication was conducted to determine if there was a statistically significant difference in nest success between the transects of different years for the HOWR Monitoring program. For the purpose of this paper, nest success is defined as nests which showed clear evidence that the nestlings had reached an age of maturity to fledge; failure is defined as those nests which showed activity at the beginning of the season, but then were abandoned, had unhatched eggs or had been predated on. It should be noted that there were Tree Swallows, TRES, and other species nesting in the HOWR survey boxes which was excluded from the data; as well, data from 2016 was not included because flooding of the weir impeded access to transect C and D. Raw data was extracted from previous years reports and included in table 1, unfortunately this meant that unless the data was included in the previous years assessment it could not be used for comparison.

RESULTS

The single factor ANOVA results compare the number of successful nests from the past 5 years (except for 2016) between transects A, B, and C (Table 2). Unfortunately, raw data for transect D was not available until 2015 when it was established, therefore it was not used for data analysis in this paper. Comparing the individual transect success rates there were apparent differences between the four areas; it can be determined that transect A had a success rate of 27%, transect B 31%, transect C 53%, and transect D 0% (Table 3). Therefore, from the total 99 nest boxes only 51 showed HOWR activity at the beginning of the breeding season, and 15 lead to successful nests outputs (Table 3). This implies that only 29% of the total nest boxes are represent in the ANOVA, and 71% of the boxes were abandoned, predated on, or occupied by competing species.

From the ANOVA results in Table 2, it can be determined that there was no statistically significant difference between the number of successful nests over the years as the $F_{calculated} < F_{critical}$, 0.88 and 3.47 respectively, and the p value for the analysis was greater than 0.05. This indicates that even with the apparent fluctuating number of successful nests it is not considered to be significant for the purpose of statistical comparison.

DISCUSSION

Overall, from the ANOVA it can be said that there has been no difference in the number of successful nests from 2014 to 2019 across three of the four transects. Despite the variability in success rates between the transects this number appears to be relatively stable throughout the history of the HOWR monitoring program. As years progress and the HOWR project continues this kind of analysis will gain stronger statistical power and stronger connections can be made between different factors. To further examine the significance in the success rates between the nests from the data in table 3 one could examine habitat differences between the transects, different vegetation, access to water, proximity of hiking of trails, etc.; by gathering more information you could potentially draw correlations. There are many different features that can impact the nest selectivity of HOWR and the success rate of those nests, including presence of predators or competing species, and nest exposure to elements are examples that are reflected in the number of active versus successful nests. For example, nine HOWR nests in transect D that showed activity as, fully or partially, built nests or eggs laid were missing the lids to the nest boxes during periods of heavy rainfall and subsequently were abandoned by the HOWR.

Another large factor that impacted the success rates of nests for the transects that I was monitoring was the presence of TRES, which was most noticeable in transect C where eight boxes were occupied by the TRES which made these unavailable to the HOWR; in fact, in transect D the only successful nest for the season was a TRES. However, there was one instance in box A2 where a HOWR took over a TRES nest midway through the season following the death of the male TRES and predation on the eggs. Now it cannot be said whether the HOWR activity impacted the fate of the TRES nest, but it can be noted that HOWR have been known to remove the eggs of competing birds to make room for their own clutches (Erickson & Alderfer, 2013; Salt & Wilk, 1966).

Predation is another factor in the success of the nests, as there were multiple nests where the eggs and/or parent birds were victims of predation. Previous studies have suggested that HOWR do not have a well-developed olfactory sense for predatory detection, since studies with and without scented predatory deterrents did not impact their activity around their nests (Johnson, Murphy, & Parrish, 2011). Having the ability to sense a nearby predatory and cease activity around a nest would be advantageous to keep the predator away from the nest until it moves onto another location. By maintaining regular activity around a nest this could potentially leave the nest and eggs/nestlings vulnerable which would reduce the success rate of HOWR in an area. At the BBO there are several predatory bird species, and predatory mammals that could take advantage of this reduced olfactory reaction to prey upon the eggs/nestlings. Each of these factors, individually and combined, contribute to the nest success of the HOWR each season as each plays a role in maintaining a balance within the migratory population.

CONCLUSION

The data from this year's monitoring program may not offer any statistically significant differences from previous years, however, it is important to understand the bigger picture surrounding the population that calls the BBO home. Historical data from the HOWR program plays an important role in monitoring and understanding the migratory population and may offer insights into the populations in other regions of Alberta. By continuing these programs at the BBO, it gives future generations the opportunity to compare population data to things like predatory populations, precipitation, and larger scale climate data.

ACKNOWLEDGMENTS

I would like to thank the staff at the Beaverhill Bird Observatory for their knowledge and insight into house wrens, and the opportunity to observe these birds in a natural and protected setting; Sara Pearce Meijerink and Emily Grose for their mentorship and guidance throughout the season, and Laurie Hunt for the opportunity to do field work with an animal I would have never expected to enjoy being around so much.

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APPENDIX

Table 1. Number of successful HOWR nests broken down by transect and year.

Transect	2019	2018	2017	2015	2014
A	3	5	6	3	5
B	4	2	3	8	10
C	8	7	5	11	8
D	0	1			

Table 2. Results from the single factor ANOVA.

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	3	15	5	7		
2018	3	14	4.666667	6.333333		
2017	3	14	4.666667	2.333333		
2015	3	22	7.333333	16.33333		
2014	3	23	7.666667	6.333333		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	27.06667	4	6.766667	0.882609	0.508209	3.47805
Within Groups	76.66667	10	7.666667			
Total	103.7333	14				

Table 3. Comparison of the number of active HOWR nests to the number of nests that showed success at the end of the season.

Transect	Active Nests	Successful Nests
A	11	3
B	13	4
C	15	8
D	12	0
SUM	51	15