

**Comparing nesting success between two House Wren nest box grids  
at the Beaverhill Bird Observatory**

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## Introduction

Located 60km east of Edmonton, near Tofield, Alberta, the Beaverhill Bird Observatory (BBO) is a bird monitoring and banding station within the designated Beaverhill Natural Area. Known for its great avian diversity, the natural area is host to a wide variety of birds and is a central stop-over hub for many migratory species, which lead to the Important Bird Area of Global Significance designation it retains today. While Beaverhill Lake itself has largely dried up over the past two decades, the smaller Lister Lake has remained a consistent feature on the landscape, providing habitat for countless waterfowl and shorebirds, including notable endangered species such as the Piping Plover (*Charadrius melodus*) (Beaverhill Bird Observatory – Songbird Migration Monitoring). The natural area and surrounding rangeland are characterized by distinct “knob and kettle” topography and extensive riparian areas, which allows for an abundance of shallow ponds and mud flats. These features, in conjunction with the diverse ecotypes throughout the remaining area, produce a heterogeneous environment that is optimal for avian biodiversity. Other habitat types in the natural area include regions of deciduous-dominant mixedwood forest, grassland, and shrubland. To take advantage of this richness, a bird banding and observation laboratory was constructed in 1984. Since then, observatory staff and volunteers have implemented several monitoring programs, including nestbox grids for Tree Swallows, House Wrens, and Northern Saw-whet Owls.

For this internship, myself and another intern monitored and collected data on the House Wren nestbox grids. House Wrens (*Troglodytes aedon*) are insectivorous, monomorphic, secondary cavity-nesting passerines (Kendeigh 1941, Alworth 1996). They are a typically monogamous - but occasionally polygamous - migratory species, breeding here in the summer and flying to the southern United States for the winter (Kendeigh 1941, Johnson 1991).

Characterized by their small, compact body, long decurved bill, and stiff, upright tail, House Wrens commonly reside in open woodland forests, but are known to take well to artificial nest boxes as well (Drilling and Thompson 1984, Finch 1989, Baicich and Harrison 2005). House wrens have a unique, bubbling song, and while it can be quite variable, identification by sound is generally easy and accurate.

As secondary cavity-nesters, House Wrens build nests in already-excavated holes or nest boxes. Males typically construct multiple nests in an area, building them up with medium-sized sticks and twigs for females to choose from (Alworth 1996). Once a female chooses a nest, usually around May in Alberta, she lines a cup with feathers, hair, or wool and lays 5-12 speckled pink-brown eggs. (Baicich and Harrison 2005). An adult female House Wren will lay eggs in daily intervals until reaching the maximum clutch size. After hatching, young Wrens will leave after approximately 12-18 days. (Baicich and Harrison 2005)

The Beaverhill Bird Observatory has a total of four House Wren nestbox grids; two across from the lake's weir, and two inland towards the lab. Due to uncharacteristically high precipitation this season, the two across the weir were flooded and thus inaccessible for the majority of the summer.

## **Methods**

The Beaverhill Bird Observatory has four established House Wren grids designated A, B, C, and D. Grids A, C, and D consist of a 5 by 5 array of nest boxes, with 25 nest boxes labelled A1 to E5. Grid B is laid out in a 3 by 8 pattern, with 24 boxes labelled A1 to C8. All nest boxes are placed around 5 feet high on live aspen or balsam poplar trees and are approximately 5-7 meters apart, for a total of 99 nest boxes across all four grids. The nest box size and structure were consistent throughout the grids, with all boxes comprised of wood with a removable lid

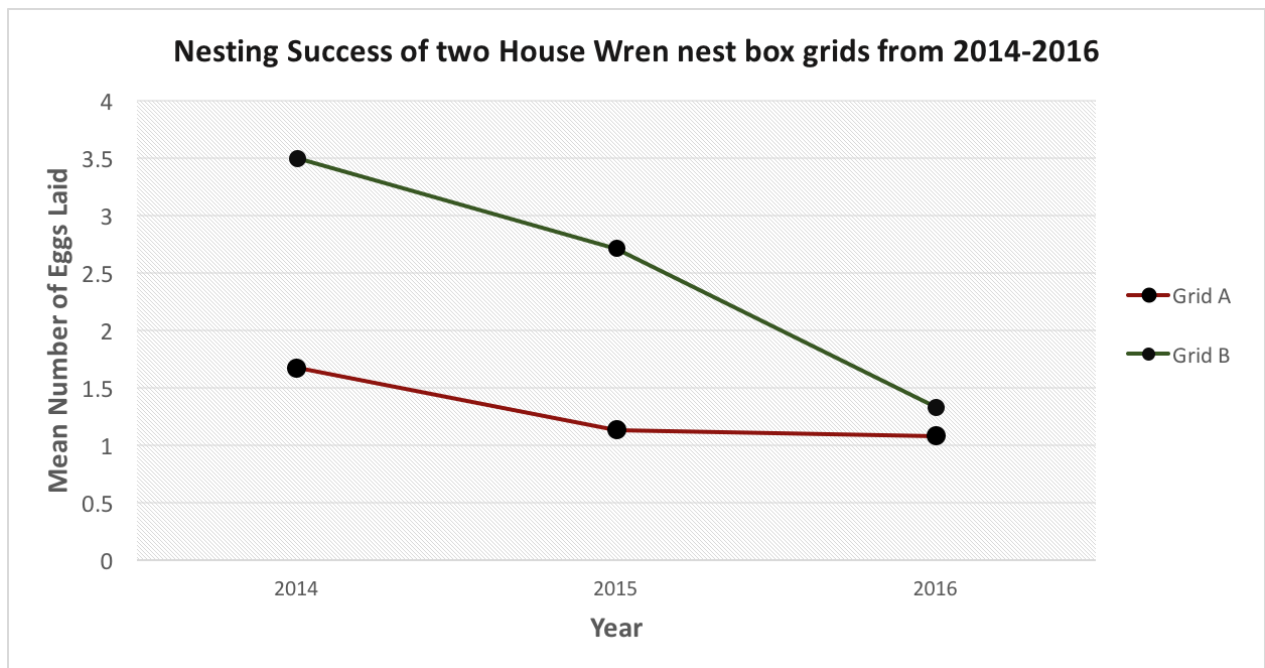
held on by wire attached to both sides for easy access. Since excessive flooding of the weir prevented access to grids C and D this season, the checks for both of those grids ceased after June 27<sup>th</sup> and will not be included in the analysis. The analysis also includes data collected from 2014 and 2015 as well as 2016; however, the nest boxes and data collection methods were consistent throughout the three years.

From June 3<sup>rd</sup> to August 7<sup>th</sup> of 2016, nest boxes were checked every 6-10 days by either myself or the other House Wren project intern. Nest box checks were completed in the morning or early afternoon. At each nest box, we recorded whether the box contained a nest, and if so, the species and presence or absence of eggs. If eggs were present, we noted the number of eggs and whether they were warm or cold to determine incubation status. The presence or absence of a potential parent in the vicinity was also recorded, and in general, this was determined by the appearance of an adult House Wren either on the nest, or in a nearby tree displaying territorial behaviour such as dive bombing or excessive calling. When the eggs hatched, the number of nestlings in the nest were recorded with their age. Aging was done using Brown's nestling digital photo guide (2013). Once nestlings were confidently aged, the age and a suggested date for banding for the nest box was provided to biologists at the observatory. Nest box checks then ceased at those occupied nest boxes to avoid premature fledging of the nestlings. Because the nest boxes are cleaned out each fall and checked again in the spring prior to the breeding season, we can confirm that all observed nests were constructed this season.

I conducted a two-way ANOVA to analyze the data for nesting success between grids and between years. For this analysis, nesting success is defined by the average clutch size for all nest boxes in a grid, whether occupied or not. It did not account for whether the eggs hatched or any event after laying.

## Results

The two-way ANOVA analysis demonstrated that there was a significant difference in nesting success between grids A and B ( $df=1$ ,  $F=5.57$ ,  $p=0.0197$ ). As shown in Figure 1, the mean clutch size was consistently higher in grid B than grid A. There were both more nests occupied and more eggs per clutch in grid B. There was also a minor significant difference in nesting success between years ( $df=2$ ,  $F=2.35$ ,  $p=0.0992$ ). From 2014-2016, the average number of eggs laid continuously declined for both grids (Fig. 1). Nesting success between the grids did not vary between years, as determined by the insignificant interactive effect in the ANOVA test ( $df=2$ ,  $F=0.9$ ,  $p=0.4089$ ).



**Fig. 1.** Nesting success represented by the mean clutch size over three years from 2014-2016

## Discussion

While the ANOVA test showed significantly better nesting success in Grid B, in addition to a slight decline in both grids over the three years, the data for this project is insufficient to determine why. The nature of the part-time internship did not allow for the time and effort

required for further data collection and analysis, but a more intensive study could provide more conclusive findings. Furthermore, being able to collect data on and compare only two of the four grids this year gives a poorer representation of the House Wren population and their breeding behaviour in the Beaverhill natural area. As such, this discussion will explore some of the literature and theories surrounding clutch size and nesting success to highlight potential contributing factors.

Ultimately, the “goal” of a bird is to produce as many healthy offspring it can with the resources it has in the environment that it is in. It is established in the literature that environmental conditions can affect clutch size and variability in songbirds. It has been shown that food abundance (Hogstedt 1981, Newton and Marquiss 1981), as well as elements of population density (Kluijver 1951, Perrins and McCleery 1989) can both have an effect on clutch size in birds. Lack’s (1947) widely-accepted hypothesis claims that clutch size is related to how the number of young the parents can provide for with the resources that are available. Although food abundance and availability may indeed be a factor contributing to clutch size, the close proximity of grids A and B suggests that this is not a likely cause of the nesting success disparity in this scenario.

It has also been stated that House Wrens are limited by nesting site availability. In this study, the two grids combined had a total of 49 nest boxes. Over the three years, only 11.7 nests were built on average for both grids together, with an average of 7 active nests with eggs for the two grids. Thus, there was an evident surplus of nesting habitat for House Wrens at the BBO, which can indirectly increase clutch size according to Dubois et al. (2006). Dubois et al. found that when male House Wrens have a surplus of nest boxes in their territory, polygyny is more

frequent and their mates lay larger clutches (2006). Again, this is not a plausible explanation for these results as both nest box grids had a large and comparable surplus of unused boxes.

Another theory that could provide some insight is the nest predation hypothesis. A study testing the nest predation hypothesis for clutch size variation in passerine birds was conducted by Tore Slagsvold and published in 1982. The results of that research confirmed a negative relationship between clutch size and the probability that the nest will be predated on, which has since been demonstrated in numerous other ornithological studies (e.g. Cassey 2009, Doligez and Colbert 2003). The risk of predation on a site is also a determining factor for where birds will select to place their nest (Pöysä 2001). For House Wrens specifically, Kendeigh (1941) and Belles-Isles and Picman (1986) discovered that nest predation was indeed a significant factor in nest site selection, and that Wrens select a site specifically to minimize loss from predators, including conspecifics. Female House Wrens are also known to select a mate based on nesting site qualities as opposed to male characteristics (Sherman 1925, Belles-Isles and Picman 1986, Eckerle and Thompson 2006); therefore, it is in the best interest of a male House Wren to build nests in higher quality sites that will minimize nest predation. In an effort to understand this better, Belles-Isles and Picman (1986) researched nest site preferences and nesting losses in House Wrens. Interestingly, the data showed that both male and female House Wrens strongly select for nesting sites that have sparse vegetation instead of dense. The authors proposed that the reason for this was that the Wrens were better able to ward off attacks from conspecifics. The additional solar radiation may also affect the required incubation amount by raising nest temperature (Kendeigh 1963).

## **Conclusion**

Overall, the data collected at the BBO for the House Wren project is inadequate to explain why the House Wrens have significantly better nesting success in Grid B and why it has been declining over the past three years. With the background literature examined in the discussion section, it would be interesting to conduct further research on why House Wrens at the BBO are selecting for Grid B over Grid A, and what environmental conditions could be influencing their behaviour. For future studies, I would recommend collecting data on vegetation densities to determine if my results are consistent with those of Belles-Isle and Picman's research (1986). It would also be worth investigating conspecific proximity and predation loss within the grids.

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