The Effects of Interspecific Competition on the Northern House Wren

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Introduction:

The newly renamed Northern House Wren (*Troglodytes aedon*/HOWR*)* migrates north, across the southern American border, and up all the way to central Canada (Argeudas and Parker, 2000) to breed. The northernmost breeding region for the house wren, the southern and central prairies where the Beaverhill Natural Area is located, has been seeing a decline in both successful nests and an overall wren presence in the last ten years (Cornell Lab of Ornithology, 2025).

Over the last 12 years the Beaverhill Bird Observatory (BBO) has documented a decline in successful HOWR nests and HOWR presence within the Beaverhill Natural Area (BNA). The BNA is located in the northeastern most part of the HOWR breeding range and BBO has been monitoring wren presence there consistently since 2013. On the property are 99 HOWR nesting boxes. These boxes are used by Tree Swallows (*Tachycineta bicolor*/TRES), Northern Flying Squirrels (*Glaucomys sabrinus*/FS), and the wrens. Because of this, our study on nesting success and location selection focuses on trying to determine possible factors of decline, but more importantly, identify possible factors for promoting nesting and breeding for HOWR in the area. In 2015, all four grids showed an overall reproductive success of ~81.13% (Jorgensen and Simard 2015). However, this was only spread over a total occupation rate of ~28.28%. In most recent data from 2024, this occupation rate dropped to just ~3% (Bilodeau, 2024).

The historical data, collected by Michael Quinn, 1986 and 1987 boasts an overall HOWR occupation rate of 24/47 boxes (Quinn 1989). The first internship program in 2013 analyzed the 49 boxes officially labelled as Grid A and B. In 2013, a total of 13/49 boxes were occupied by HOWR which is a notable decline when compared to 1986/87. Eleven years later, 2024 reports 55 occupied boxes out of the now 99 boxes over all four grids. However, of these 36 were successful TRES nests. That year, there were only 3 successful HOWR nests (Bilodeau, 2024). This could be due to many factors, but one is interspecific competition with TRES and even FS (Bilodeau, 2024). The decrease in occupation rate is married with an

increase of TRES presence. While HOWR are a species with little issue with competition (Finch, 1990), the presence of TRES reflects the decrease in total HOWR nests in boxes. The goal of our internship in 2025 was to monitor the HOWR grids, collect this data again, with the addition of an experimental grid, Grid E. The purpose of this grid, located in the vacant space between Grids A and B, is to utilize entrance coverings on the boxes, shrinking the entrance hole to allow only HOWR to enter the boxes. This is done in an attempt to eliminate interspecific competition in our data for that grid. The remaining grids will demonstrate current nesting habits and percentage.

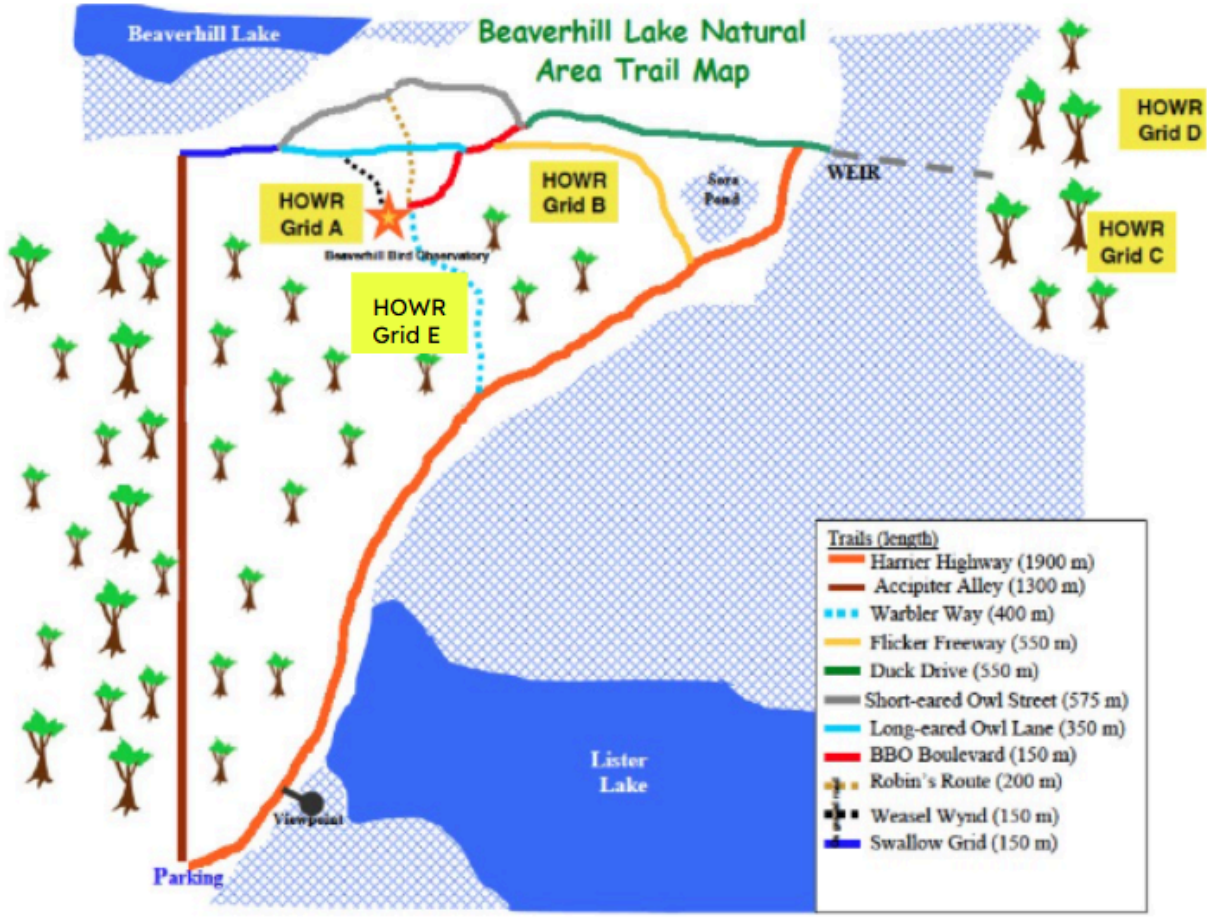

Fig. 1. Beaverhill Bird Observatory Trail Map and HOWR Grid locations. (BBO Manual, 2022).

It is important to note the effects of interspecific competition. HOWR tend to be aggressive, destroying other clutches to provide for their own (Picman, Pribil, 1991). For this reason I hypothesize that the presence of tree swallows will not

drastically affect the nesting rate, despite their previous recorded presence in the boxes. Wrens will kill eggs, consume eggs, and force other species further away, increasing food availability in addition to nesting space (Picman, Pribil, 1991). Males usually do this to create multiple available nests, as the female will choose the one she prefers, and will likely be forced away from the nests occupied by TRES (Finch, 1990). To attempt to test interspecific competition as a factor, we modified 5 of 9 boxes on Grid E with smaller holes, to prevent TRES occupation. This will allow us to determine if competition and availability are possible primary reasons for a declining wren presence at the BBO.

Methods:

The Beaverhill Natural Area, located east of Edmonton Alberta, is home to the Beaverhill Bird Observatory. This organization has been recording population numbers in the HOWR and TRES species, along with many others. Started in 1984, they maintain a rich concentration of birds and other wildlife on over 44, 000 acres of land (BBO, 2022a). Monitoring of species includes banding of migratory birds, monitoring of bat boxes, butterflies, birds of prey, songbirds, and winter education through their BirdSmart student oriented program. As of time of writing, in late August of 2025, the area has boasted 168 species of birds sighted in 2025, and 258 species from all years (Cornell Lab of Ornithology, 2025). This abundance of species in the area includes a variety of woodpeckers, meaning there is a presence of primary cavity dwellers in the area, which improves nest site availability for the wrens (Finch, 1990).

Within the natural area, 99 wooden nest boxes make up Grids A-D. Grids A and B are located near to the main banding station, with Grids C and D located less than 1km east on the east side of the Lister Lake Weir. Our experimental Grid E was set up in the open space between Grids A and B, and contained 9 boxes, arranged 3x3. 5 of these 9 boxes were fitted with metal holes of reduced size (1 ¼” vs 1 ⅛”) to prevent TRES nesting. These Grids were then cleaned post-winter, and monitored every week beginning May 25, 2025, with Grid E established in early June, and

monitoring of Grid E starting on June 8. This consistency in monitoring was determined by weather conditions, but was carried on until the second week of August, when full fledging of nestlings had occurred.

Nesting boxes were checked for the presence and contents of a nest. We recorded the state of nests, whether they were TRES or HOWR nests, or both. This was determined by the contents of the boxes (Old Manual, 2022). The number of eggs, presence of an adult, and state of the nests were recorded every week for the duration of the season. The same process was carried out for TRES in the boxes, so as to record interspecific competition, as well as to ensure successful breeding for both species' nests. Some boxes were also inhabited by FSs. Their presence was recorded as well. Success of nests were followed throughout breeding season and past fledging to document the success of juvenile birds. Once both HOWR and TRES eggs had hatched, the nestlings were aged by visual guide until day 7 for HOWR and day 10 for TRES (BBO, 2022b). At this point the nests were given at least 24 days of no monitoring to prevent early fledging (Halliwell et al. 2023). After the fledging period, boxes that demonstrated recent fecal matter and an absence of young were recorded as successful, and boxes containing dead eggs or young were recorded as unsuccessful.

Data Collection and Analysis:

Data was collected in the field and scanned or uploaded to Google Sheets throughout the summer. Data was analyzed using a chi-square independence test, after uploading Grid E and all other relevant data into Microsoft Excel. This grid compared with the other grids, determined whether or not interspecific competition was a significant factor. After that we took our nesting rates as percentages from each grid to determine a general nesting success rate over all grids.

Data was separated, TRES separate from HOWR, successful from unsuccessful nests, and each grid independently, to test nesting success and competition, but also the possible effect of the hole inserts in Grid E. Due to a lack

of activity in the experimental grid, raw data did not present enough information to run a statistical test on the use of inserts. For this reason, Grid E was excluded from the nesting rates tests. Nests that produced young, and were vacant after the fledging period, were considered successful. To isolate interspecific competition, HOWR nests that were taken over by TRES were recorded, but for the test were identified as a TRES nest. TRES nests had to produce young to be considered successful, but for HOWR just the presence of an active, uncontested nest was considered successful. The last day of data collection was August 4, 2025 (Undheim, Flynn, 2025).

The null hypothesis was that there is not an association between TRES and HOWR competition and nesting success. The alternative hypothesis was there was an association between competition and nesting success in the two species. The chi-squared independence test was chosen to both calculate an expected number of nests per species per grid, and also to analyze the statistical evidence of interspecific competition.

observed	A	B	C	D	total
HOWR	0	0	3 (2 succ)	3(2 succ)	4
TRES	12	5	18	9	46
Total	12	5	21	12	50
expected	A	B	C	D	
HOWR	0.96	0.4	1.68	0.96	
TRES	11.04	4.6	19.32	11.04	
(O-E)^2/E	A	B	C	D	
HOWR	0.96	0.4	0.06095	1.12667	
TRES	0.08348	0.03478	0.09019	0.37696	
x^2	3.13302				
df	3				
p-value	0.37157				

Table 1. Microsoft Excel Chi-squared independence test. Note the 4 total identified HOWR nests. The other two were taken over by TRES later in the breeding season.

Results:

The test and data showed a total of 4 HOWR and 46 TRES nests (Table 1). The chi-squared value comes to 3.133, which shows significant association when compared with the critical value of df=3. This result, especially the p-value, demonstrated rejection of the null hypothesis; there was strong association between the nesting rates and success of HOWR and TRES on the BBO. The very low expected rates of HOWR nesting was nearly zero. This value showed the low population that the BBO had already been seeing in previous years, enforcing the pattern of decline.

There were basic parameters for successful breeding. On average, the TRES clutch size was 6.26 eggs. The average brood size at 7 days was 4.62 nestlings. For HOWR, the average clutch size and average brood at 7 days was the same, at 4.0. Therefore HOWR nests that laid eggs were 100% successful, and TRES nests that laid eggs had a fledging success rate of 73.8%.

Discussion:

A number of other variables played on nesting availability. Some boxes remained inactive for the whole season, due to weather or other large animals knocking them down. The Natural Area hosts whitetail deer and moose, who will knock against trees and rub their antlers against lower branches and trees. 3 boxes in Grid C were knocked down throughout the monitoring. This was likely an ungulate, as Grid C is furthest from human contact. FS also inhabited some boxes throughout the season, primarily in Grid B. While no significant data shows the squirrels as key factors, the FS occupied boxes were not taken over by either species of bird at any point in the season. On a nature preserve with 99 available boxes, an expected value of near zero clarifies the presence of an external factor. That factor is TRES nesting.

Main trends from previous years were also reflected in the findings of the 2025 data. The overall presence of nests, especially when compared with historical data, is in a decline. It is important to note that the northeastern region where the BBO is located is seasonal breeding grounds, and not year-round habitat. Therefore, the BNA could be on the forefront to witness population decline. In face of the 2025 data results, this is largely due to the presence of TRES.

There was only one successful breeding of HOWR recorded in the boxes. The other nests were active but with no breeding. A large portion of the HOWR sign seen earlier in the season was then taken over by TRES. There was very little evidence to suggest that the HOWR were fighting for their boxes; almost all early nests became forfeit. However, there were many vacant boxes that the HOWR could have occupied.

There is a consistent amount of human activity in the BNA. It is a local birding destination, especially for migratory species passing over the western prairies. While likely not significant, Grids C and D showed an overall larger occupation rate. These grids are the ones furthest away from human interaction and possible disruption (Fig. 1). However, Grids A and B are not directly near trails that people use.

If the BBO was to pursue boosting HOWR nesting, these results lend a few suggestions. While we did not find conclusive data on the hole inserts, the effect of competition suggests that limiting access to the boxes could change the results. As well, a new attachment method to the trees for the boxes might stop local ungulates from knocking down the boxes. During monitoring, there were multiple boxes every 2-3 weeks that had been knocked down, exactly 3 in Grid C. Birds trying for boxes that constantly are being reinstalled are going to be too disturbed to establish successful nests. An overriding number is that only 50 of 99 boxes were occupied. A large proportion of boxes were vacant despite occupancy by TS and FS. Alternatively, a wide use of hole inserts earlier in the breeding season would also provide clear data on their effectiveness.

Conclusion:

This study targeted the effects of interspecific competition on house wren nest selection and success. It was evident that TRES provided significant pressure on breeding HOWR. HOWR did not fight for an inactive nest, and therefore did not attempt to take back their nests. Contrary to my hypothesis, interspecific competition may be affecting the HOWR breeding in the BNA. Also, the presence of larger animals, from FS to even humans, may put supplementary pressure on the HOWR and TRES breeding as a whole. Actions could be taken to try and bring back a healthy wren breeding ground, and monitoring of grids will have to remain consistent to observe the results. But foundationally, an increase of wrens would have to be coupled with mitigation of TRES activity. If current trends continue, TRES will occupy most boxes, and HOWR will likely avoid the area for breeding altogether. An alternate hypothesis is that the decline is the growth of the aspen and deciduous forest over the past 40 years from an early successional forest in the 1980s when the Quinn study was conducted. Another possibility is that House Wren populations at the northwest edge of their breeding range have declined. Being on the edge of the range, the BNA would observe earlier signs of population decline than further south. The Breeding Bird Survey shows a 65% decline in House Wren numbers from 1994 to 2022 (USGS 2025). The low occupancy of the boxes in the Beaverhill Natural Area could reflect this decline. More research is needed to determine the causes(s) of the decline in House Wrens in the BNA's nest boxes.

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