Effect of Habitat Type on Parental Care in House Wrens (*Troglodytes aedon*)

A Senior Thesis

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By:

Jacob Sawmiller

The Ohio State University

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Project Advisor: Dr. Jacqueline K. Augustine, Department of Evolution, Ecology and Organismal Biology
Abstract:

Anthropogenic degradation of habitat may limit reproduction and survival of wild organisms. However, some species thrive in urbanized areas. House Wrens (*Troglodytes aedon*) are migratory passerines that live in a variety of habitats. We hypothesized that the wrens would be more successful in undisturbed habitats when compared to habitats that have been significantly altered by human actions. We used parental visitation rates to the nest box as a measure of reproductive effort because the quality of parental care may determine offspring survival to adulthood. We monitored 123 nest boxes distributed among a forested habitat, a golf course, and a residential area. We checked all of the boxes twice weekly for signs of nesting and daily when egg laying and hatching was expected. On days 4 and 10 after hatching, we observed how frequently the adults visited the box for 30 minutes. We found no difference in visitation rate or reproductive success among habitats. However, despite having similar numbers of nest boxes in each habitat, wrens occupied more boxes at the golf course than the other two areas. Our data suggest that House Wrens may benefit from moderate levels of habitat disturbance.

Introduction:

Urbanization can have a significant negative impact on an ecosystem. For example, urbanization can cause reduced food abundance and a reduced availability of nesting sites (Filippi-Codaccioni et al. 2008). Previous studies have suggested that avian populations can be good indicators of habitat quality (Pérot and Villard 2009), so,
by studying the effect urbanization has on birds, we can learn how to minimize our detrimental influence on the affected animals and habitats.

In a variety of bird species, parental care is essential for raising independent offspring that will in turn be successful competitors for resources and mating opportunities (Robinson and Rotenberry 1991). Offspring in a cohort with reduced parental care have a significantly higher mortality rate than those with sufficient parental care in the same cohort (Bart and Tornes 1989). For this reason, it is important that changes made to an organism’s environment should not hinder parental care.

House Wrens (*Troglodytes aedon*) are well suited for observational studies of urbanization because they are common in northwest Ohio, and their nesting process is easily observed (Kendeigh 1941). In natural environments, House Wrens prefer to nest in small cavities in trees (Johnson 1998), but they will readily nest in manmade boxes that are provided for them (Newhouse et al. 2008, Krohn and Augustine 2010). One problem with urbanization is that, in disturbed habitats, the House Wrens preferred nesting sites, dead trees, are cut down and therefore the number of available nesting sites is reduced. Because there are fewer nesting sites available, the wrens will sometimes try to nest in crevices in the side of buildings, but they are unwelcome guests and are usually removed. Another problem is that urbanized areas typically offer less food for the wrens. House Wrens are insectivores, and pesticide use in urbanized areas decreases the abundance of insects (Johnson 1998).

In this study, we observed wren behavior at nest boxes; specifically, the rate at which parents in different habitats feed their offspring. My hypothesis was that House
Wren parents in disturbed areas would not find as much food as their undisturbed counterparts and would produce fewer, smaller offspring and have reduced feeding rates. Two previous studies compared feeding rates of House Wrens in disturbed and undisturbed areas (Newhouse et al. 2008, Krohn and Augustine 2010). However, my study expands upon this previous work by examining the feeding rates of House Wrens in a residential area in addition to moderately-disturbed and undisturbed areas.

**Methods:**

**Study Species:**

House Wrens are very common in many locations in the western hemisphere (Rappole and Blacklock 1985). House Wrens are, for the most part, socially monogamous with high levels of extra-pair paternity, but some males can be polygamous. Typically, both parents provide care for their offspring (Bart and Tornes 1989). To court females, males pick a territory and construct one or more nests to entice a female to mate with him. House Wrens typically build nests in holes in dead trees or crevices in other structures without displaying a preference for size of the crevice or what structure the crevice is located in (Johnson 1998). Wrens are insectivores and typically spend most of their time on the ground or in the subcanopy (Mirsky 1976). Most House Wrens are able to produce two clutches in a single breeding season (Johnson 1998).

**Field Techniques:**

In late April, the nest boxes were set up in three locations: the edge of a forest on Ohio State University’s Lima Campus (40.743338, -84.017129), Hawthorne Hills
Country Club (40.75551, -84.026012), and a residential area near the campus (40.747248, -84.039488). All locations are within 5 km of each other. The nest boxes at the forest were on a trail that is bordered on one side by thick forest and bordered on the other side by a large field with tall prairie grasses. The nest boxes at the golf course were located in the shrubby fencerows surrounding the greens. In the residential area, the boxes were located on the edge of residential property where ornamental trees and shrubs dominate the landscape. The nest boxes are 10.1 cm wide by 14.0 cm long by 20.3 cm high. The opening in the box is a circle with a diameter of 2.9 cm and is located 2.5 cm below the top of the box. The small size of the hole is designed to deter many other bird species from entering the box. A sliding door is attached to the front of the box and is used to trap the adult wrens for tagging and measurements. The boxes were placed a minimum of 30 m apart to reduce male territoriality (Muller et al. 1997). A total of 123 boxes were set up with 40 boxes at both the woods and golf course, and 43 at the residential area.

The boxes were observed every 3-4 days starting the last week of April until the second broods fledged in mid-August. Daily nest checks occurred when laying and hatching were expected. Laying was expected when nest cups were observed, following several days where sticks were added in a disorganized manner. Hatching was expected 12 days following clutch completion (Newhouse et al. 2008). The daily nest checks provided information about the date the first egg was laid, clutch size, hatching date, and hatching success for the first and second clutches.

The adult wrens were banded when the nestlings were 6-8 days old by trapping them in the nest box when they came to feed their offspring (Drilling and Thompson
1984). The birds were weighed and wing, tail, and tarsus length were measured. Every individual was banded with federal USGS aluminum bands and a unique combination of colored leg bands to aid in individual identification. The nestlings were banded with an aluminum band and a single colored leg band to indicate the location in which they were hatched (woods, golf course, or residential area) and measured in the same manner as the adults 10 days after they hatched with day one being the day of hatching.

**Feeding Observations:**

Both wren parents were observed on days 4 and 10 after hatching to determine how often the parents were feeding their offspring. By day 10, the parents had been banded so they were easily identified by gender. If possible, the gender of the parent was determined on day 4 by examining the bird’s behaviors with regards to feeding patterns or singing. Females were easily distinguished because they often stayed inside the nest box for longer than one minute, while males always left the nest box after a few seconds (Newhouse et al. 2008). Males were easily distinguished because they sang frequently while on top of the nest box, and females rarely sing (Price et al. 2008). The observers sat approximately 15 meters away from the box and used a pair of binoculars (Eagle Optics Denali 8x42) and a spotting scope (Zeiss Diascope 85FL 20-40x80 magnification) to record the number of trips each parent made to their box for 30 minutes (Newhouse et al. 2008). The wrens were more active in the morning, so all observations occurred between sunrise and six hours after sunrise. For each observation, the date, temperature, weather (0=clear, 1=partly cloudy, 2=cloudy, 3=rainy), wind (0=0 km/h, 1=1.6-8.1 km/h, 2=8.1 km/h, 3=8.1-16.1 km/h, 4>16.1 km/h), age of nestlings, and time of day were recorded.
Statistical Analysis:

We determined whether differences in egg laying date, clutch size, hatching and fledging success, feeding rate, and nestling and adult mass, tarsus length, and wing length varied by location (woods, golf course, or residential area). We also examined the effects of possible confounding variables such as date, weather, temperature, and observer bias where appropriate. All data were analyzed using the program JMP version 9.0.0 (SAS Institute Inc., Cary, NC). Nesting success was coded as ‘yes’ if one or more nestlings successfully fledged, or ‘no’ if no nestlings fledged. The codes used to quantify feeding bias are as follows: 0=all female feeding, 1=mostly female feeding, 2=equal participation, 3=mostly male feeding, 4=all male feeding. Means are presented with their SD.

Results:

Of 123 nest boxes, 65 boxes contained at least one nest. The proportion of nesting attempts was highest at the golf course and lowest in the residential area (Table 1). There was no difference among locations in laying date (Table 1). The average clutch size was 4.97±1.53 eggs. Clutch size decreased with laying date (F=20.4, P<0.0001), but did not vary by location (Table 1; overall F3,67=3.07, P=0.03). Number of nestlings hatched increased with clutch size (F=6.90, P=0.01), but there was no difference with laying date (F=0.0017, P=0.97) or location (Table 1; overall F4,66=2.40, P=0.06). Number of nestlings fledged increased with number hatched (F=51.86, P<0.0001) and decreased with laying date (F=4.57, P=0.04), but there was once again no difference among locations (Table 1; overall F4,84=21.64, P<0.0001). Mean nestling
mass did not vary among locations (Table 1) or with laying date (F=0.29, P=0.60; overall: F$_{3,35}$=0.72, P=0.55). Nesting success decreased with laying date (Figure 1; N=89, $\chi^2$=19.21, P<0.0001), but there was no difference among locations (Table 1).

A total of 108 feeding rate observations were conducted. Feeding rates were not affected by weather (temperature: F=0.76, P=0.73; wind: F=0.66, P=0.65; sky: F=0.29, P=0.83; overall: F$_{24,63}$=0.77, P=0.43). There was no difference in visitation rate among locations at 4 (average 9±5 visits) or 10 days (average 10±7 visits) after hatch (Table 1), and there were no effect of observer (4 days: F=0.62, P=0.54; 10 days: F=0.18, P=0.84), date (4 days: F=2.05, P=0.16; 10 days: F=1.64, P=0.21), or start time (4 days: F=3.58, P=0.07; 10 days: F=2.13, P=0.15; overall, 4 days: F$_{6,42}$=1.99, P=0.09; 10 days: F$_{6,31}$=1.04, P=0.42). Feeding bias at 4 days after hatch was not different among locations ($\chi^2$=2.91, P=0.23) and did not change with date (N=47, $\chi^2$=0.003, P=0.95). At 10 days after hatch, feeding bias was not different among locations ($\chi^2$=1.15, P=0.56), but it did change with date (N=35, $\chi^2$=5.32, P=0.02) with feeding being more female-biased later in the season.

**Discussion:**

Our hypothesis was not supported because feeding rates and reproductive effort and success did not differ among habitats. These results are consistent with those of previous studies on House Wrens (Newhouse et al. 2008, Krohn and Augustine 2010), but studies on other species, like studies conducted on the Common Blackbird (*Turdus merula*) or European Starlings (*Sturnus vulgaris*) did find a variation in feeding rate between habitats (Mennechez and Clergeau 2006, Ibáñez-Alamo and Soler 2010). We
were expecting to find a difference in feeding rates because our study included a third 
study site; the residential area, and represented a wider range of disturbance than 
previously investigated. This suggests that the levels of prey availability were 
comparable in all three studied locations, despite differences in vegetation composition 
and structure. It is possible that there is ample food in all three locations for the House 
Wren parents to find or perhaps pesticides were used less frequently or less efficiently 
than expected.

However, we did observe that the wrens attempted more nests at the golf course 
when compared to the woods and residential habitats. This suggests that, although the 
wrens can reproduce equally successfully in all three locations, there is something 
about the golf course that they prefer. House Wrens may pick a specific microhabitat 
within a larger habitat when choosing where to establish a nest, and the golf course 
may have more microhabitats that are suitable for the House Wrens. Other studies 
have shown that similar species also nest preferentially at golf courses; such as the 
Eastern Bluebird (*Sialia sialis*; LeClerc et al. 2005). However, the underlying 
mechanisms leading to this trend are unknown. It is hypothesized that there may be 
some effect of pesticide use or water availability that concentrates food sources for 
insectivores. Another idea suggests that predation rates may be reduced at golf 
courses. It is also possible that the golf course was more suitable for the House Wrens 
because the golf course is watered frequently using a sprinkler system, while, more 
importantly, the other habitats did not receive additional water during the dry summer 
months. Future studies should look more closely at this trend to find out exactly what 
causes this preference. This could be done by studying the three different locations to
find any differences in factors such as food availability, nesting site availability, water availability, watering and pesticide use, or predation rate.

Finally, we also found no difference between habitats with regards to clutch size, nestling size, and nestling survival. Given that wrens attempted more nests at the golf course, we might also expect clutch size, nestling size, and nestling survival should also be greater at the golf course. However, we did not find higher reproductive output at the golf course, so there must be some interaction occurring that allows the wrens to have equal reproductive success at all three locations. Other studies have also found no reproductive differences with varying levels of urbanization, including a study on Acadian Flycatchers (*Empidonax virescens*; Rodewald and Shustack 2008). However, studies on Eastern Bluebirds and House Wrens have found higher fledging success at golf courses and urban sites (Newhouse et al. 2008, LeClerc et al. 2005, Cornell et al. 2011). These differences could possibly be caused by a difference in geographic area, which in turn affects the abundance and type of predators and food.

The kind of work that was done in this study is important because as our world continues to become more urbanized, we need to understand the effects these changes will have on local wildlife. Thankfully, in this case, the data suggest that House Wrens are tolerant of these changes because we found no difference in nest size, nest success, nestling size, or feeding rate between locations. Obviously, House Wrens could only tolerate so much anthropogenic disturbance, but this study shows they can handle a significant amount of anthropogenic disturbance that may be devastating to other species.
Acknowledgements:

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References:


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Table 1: Reproductive variables [means ± standard deviations (N)] of House Wrens in three habitats in Lima, Ohio in 2011.

<table>
<thead>
<tr>
<th>Natural Area:</th>
<th>Golf Course:</th>
<th>Residential:</th>
<th>Statistic:</th>
<th>P-value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of Nesting Attempts</td>
<td>0.55 (40)</td>
<td>0.83 (40)</td>
<td>0.23 (43)</td>
<td>X$^2$=31.32</td>
</tr>
<tr>
<td>Laying Date (June)</td>
<td>18.3±24.2 (33)</td>
<td>14.8±23.3 (52)</td>
<td>13.5±19.6 (11)</td>
<td>F=0.29</td>
</tr>
<tr>
<td>Clutch Size</td>
<td>5.92±1.20 (26)</td>
<td>5.92±1.28 (37)</td>
<td>6.00±0.53 (8)</td>
<td>F=0.14</td>
</tr>
<tr>
<td># of Nestlings Hatched</td>
<td>3.36±2.77 (33)</td>
<td>2.83±2.90 (52)</td>
<td>2.64±3.07 (11)</td>
<td>F=0.26</td>
</tr>
<tr>
<td># of Nestlings Fledged</td>
<td>1.38±2.40 (29)</td>
<td>2.06±2.76 (49)</td>
<td>1.45±2.50 (11)</td>
<td>F=1.76</td>
</tr>
<tr>
<td>Mean Nestling Mass (grams)</td>
<td>8.90±0.59 (14)</td>
<td>9.42±0.76 (22)</td>
<td>9.23±0.64 (3)</td>
<td>F=1.05</td>
</tr>
<tr>
<td>Proportion of Successful Nests</td>
<td>0.28 (22)</td>
<td>0.39 (10)</td>
<td>0.18 (33)</td>
<td>X$^2$=2.23</td>
</tr>
<tr>
<td>Feeding Rate at 4 Days (# visits/30 min)</td>
<td>8.74±4.66 (19)</td>
<td>9.37±4.95 (27)</td>
<td>11.75±2.50 (4)</td>
<td>F=1.21</td>
</tr>
<tr>
<td>Feeding Rate at 10 Days (# visits/30min)</td>
<td>8.71±6.22 (14)</td>
<td>10.57±8.07 (21)</td>
<td>5.67±4.93 (3)</td>
<td>F=0.51</td>
</tr>
</tbody>
</table>
Figure 1: Probability of nest success as a function of laying date. Dots at $y=0$ indicate failed nests where no nestlings fledged. Dots at $y=1$ indicate successful nests where at least one nestling was fledged ($N=89$).