Summer 2008

Mapping Eastern Bluebird (Sialia sialis) Land Use in the Face of Anthropogenic Activity

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Introduction and Study Question

• Anthropogenic activity can have both long and short term impacts on wildlife, having significant effects on natural populations with observed changes in behavior, physiology, and reproduction (Kight and Swaddle 2007).

• During the 20th century, bluebird numbers decreased significantly due to the destruction of their habitat—for agricultural purposes and for "timber management".

• Natural eastern bluebird habitat consists of "previously excavated cavities in dead pine trees in low density tree stands and forest edges" (Kight and Swaddle 2007).

• The construction of bluebird trails (aggregations of nest boxes) in areas of altered habitat has greatly restored population numbers. Constructed nest boxes are generally placed in open-field areas in close proximity to human development. This is believed to have caused selective pressures in bluebird populations.

Question: How does human disturbance affect eastern bluebird habitat use and reproductive success?

Hypothesis and Predictions

Hypothesis: Areas of greater human disturbance will have adverse effects on chick growth.

Predictions:
1) Chick mass will be lower in nest boxes in greater proximity to human activity.
2) More chicks will fledge from nest boxes exposed to lower levels of human activity.
3) Parents will make fewer feeding trips from nest boxes with greater natural habitat.
4) The habitat with the lowest Landscape Development Index (LDI) coefficient will be the most utilized as a food resource.

Methods

• 55 bluebird nest boxes were monitored during the 2008 breeding season (April-July) in Mount Vernon and Gambier, Ohio at the Brown Family Environmental Center (BFEC), Wolf Run Park and various residences in the community.

• We estimated nest hatch dates by adding 15 days to the date of the last laid egg.

• Chick growth data (mass, wing length, tarsus length) were measured on days 2, 4, 8, and 15, with day 0 as the hatch date.

• I observed adult bluebirds on days 1, 2, 3, 4, 8, 12, and 15 for 60 minutes each. The time of day was consistent for each observation. Parent behaviors were sampled continuously with a Newton handheld computer with Ethoscribe software (Tima Scientific). The direction of male and female flight, in and out of the nest, the number of feeding visits and the duration of each feeding visit was recorded.

• GPS points for each bluebird nest box were plotted on aerial photographs using ArcGIS 9.2. A 100m radius buffer was created around each nest box and plant community surveys (categorizing land type and recording dominant species) were performed within these buffers to identify potential food resources.

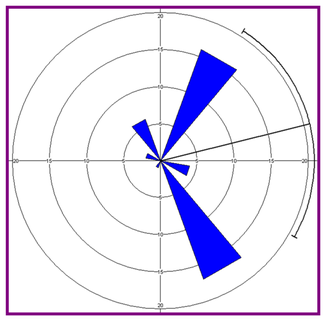

Figure 1: Circular histogram of the frequency and direction reflecting where the female parent obtains food.

Figure 2: Aerial photograph of nest box 209 Ward with the overlaying 100 m radius buffer.

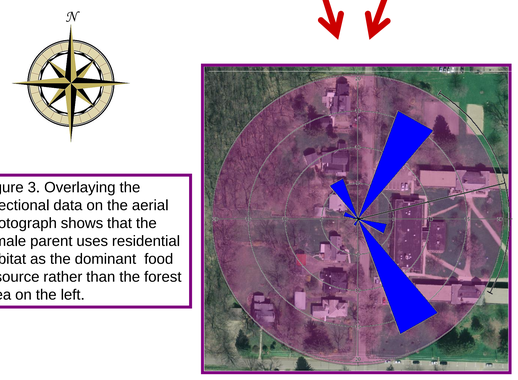

Figure 3. Overlaying the directional data on the aerial photograph shows that the female parent uses residential habitat as the dominant food resource rather than the forest area on the left.

Females used habitats with greater human activity as food resources.

Chick growth was not impacted by distance to road.

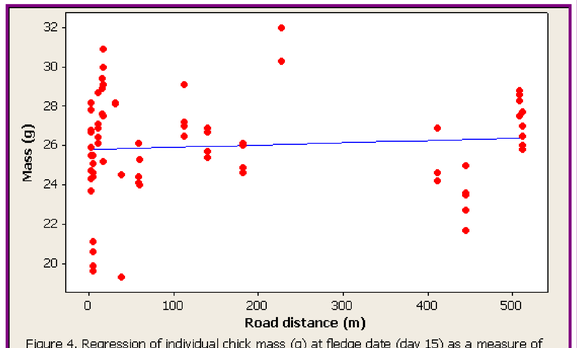

Figure 4. Regression of individual chick mass (g) at fledge date (day 15) as a measure of chick growth at each nest box to the corresponding distance from the nearest major road. (y = 0.001138x + 25.80, R^2 = 0.7%, p = 0.464). N = 78

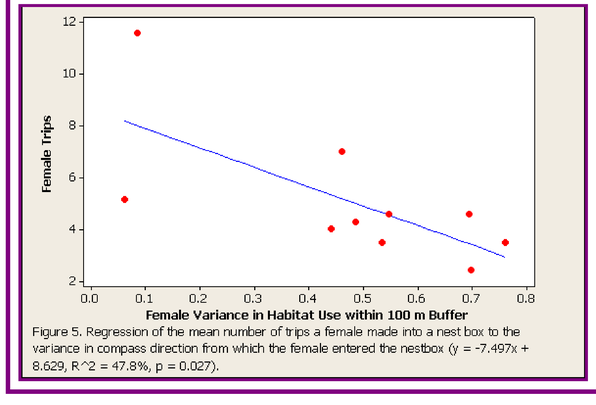

Figure 5. Regression of the mean number of trips a female made into a nest box to the variance in compass direction from which the female entered the nestbox (y = -7.497x + 8.629, R^2 = 47.8%, p = 0.027).

Parents that exploit more habitats make fewer trips to feed chicks.

Results

• 39 total clutches were laid and 19 had successful fledglings (48.7%).

• Of the 78 total chicks fledged: 43 males, 31 females, and 4 undetermined sex.

• 83.3% of successful fledglings were raised in nest boxes that were monitored; 55% of failed clutches were in boxes that were not monitored.

• 42.1% of successful and 52% of failed clutches had perches (defined as a post or fence on which bluebirds could rest before entering the nest box).

• Out of the 19 successful clutches, 5 were in boxes with overlapping buffers during various stages of chick development. 2 clutches failed at 2 other nests whose buffers overlapped during the same stage of development..

• Forest edge was present in the 100 m buffer of 84.2% of successful clutches.

• Successful clutches lay 146.1 m (mean) from the nearest major road whereas failed clutches lay 351.4 m (mean) from the nearest major road.

• Increased time a female spent in the nest box corresponded to an increased mean chick mass/ nest box (R^2 = 61.5%, p = 0.021).

• The total mass/nest box increased with more parental feeding trips (R^2 = 43.7%, p = 0.074).

Conclusions and Recommendations

• There was no correlation between the LDI and chick growth for each nest box.

• Greater directional variance corresponded with fewer feeding trips for female parents, suggesting that the females use more habitats and make fewer trips because they have to search for food more actively.

• Bluebirds selectively chose nest boxes closer to human activity and forest edge; Blair (1996) and Francl and Schnell (2000) found that certain species benefit from the greater quantity and variety of resources (i.e. perching and nesting sites) that occur with intermediate levels of development.

• **PLACEMENT:** Future nest box sites should be located at intermediate levels of human activity, no more than 200 m distance from the nearest road in an open-field area with access to forest edge.

• **MONITOR**: Bluebird boxes should be monitored as frequently as possible during the bluebird breeding season to remove old nest materials and prevent other bird species from building on top of bluebird nests.

Acknowledgements

I would like to thank Siobhan Fennessy and Robert Mauck for their guidance, analysis assistance, and field work expertise, Eric Holdener for his help creating the ArcGIS map, and Liz Carlton for her wonderful company and data collaboration. The Kenyon College Summer Science Program and Kenyon College Department of Biology provided funding for this project.

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