Summer 2005

Bluebird (Sialia sialis) Response of Sex Ratio to Habitat and Resource Availability

Amy Strieter

An adult male bluebird.

Bluebird (*Sialia sialis*) Response of Sex Ratio to Habitat and Resource Availability

Amy Strieter and Dr. Ray Heithaus

Biology Department, Kenyon College, Summer Science 2005

Female chick at 12-14 days old.

Abstract:

Some bird species produce more males than females when resources are abundant. The Eastern Bluebird, *Sialia sialis*, may be one such species. In this study, feeding by bluebirds was observed as an index for resource availability so it could be compared to sex ratios in offspring from this season. Adults were captured, and chicks were removed at fourteen days old to be banded and weighed. Average nestling weight was used as an index of the availability of resources for parental feeding. Average nestling weight was also compared to sex ratios to show whether resource availability affects selection for offspring sex. It was hypothesized that the resource index of nestling weight would correlate positively to the percentage of males in a brood and this was observed.

Introduction:

The Eastern Bluebird, *Sialia sialis*, has previously exhibited a pattern seen in other birds of producing more males than females when resources are abundant (Kordonowy, 2003). This is thought to be because males can father chicks of many females in a single season, and thus are more reproductively successful. Females are produced more frequently in difficult seasons because although they mate with only one male per season, they are more likely to contribute to the next generation. Females are also smaller and their eggs easier to lay. Previously, it has been shown that bluebirds can subtly determine the sex ratio of their offspring in response to environmental conditions or food supply (Arnold, 2003).

The bluebird population at the Brown Family Environmental Center has been studied for the previous two summers. In 2003, high resource availability corresponded to a high male ratio (Kordonowy, 2003). In 2004, mealworms were added to half the nests, but there were extensive blowfly infestations, and results did not clearly indicate a correlation between sex ratio and resource availability (Lundberg, 2004).

This study was designed to use chick weight as an index of habitat quality to test whether resource availability affects sex ratios. To enlarge the sample size in this experiment, and to provide multiple habitat options for the bluebirds, additional boxes were installed in Knox County Regional Wolf Run Park. This reserve is 1.5 miles from the BFEC.

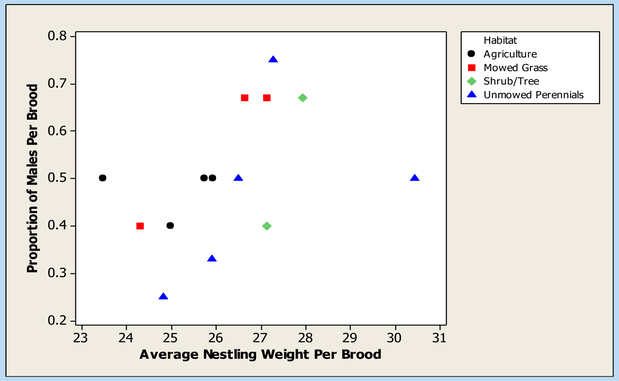

Figure 2: Sex ratio as a function of nestling weight in different habitats: these results indicate that nestling weight has little effect on sex proportion (Regression analysis, T = 1.67, P = 0.121).

Table 1: Habitat types as we defined them did not correlate with fledging success (Chi^2 = 1.363, df = 3, p = 0.714).

Habitat	Mowed Grass	Unmowed Perennials	Shrub/Tree	Agriculture
Fledged	2	6	2	4
Not Fledged	10	14	3	14
Total	12	20	5	18

12-14 day old chicks in the nest.

Color developing in plumage of 13-day-old male chick.

Methods:

There were 24 boxes in Wolf Run, 22 boxes at the BFEC, 8 boxes at Pleasant Street School, 1 box at Dr. Fred Baumann's home near Gambier, and 1 box on Jerry Simpson's property at Grove Church and Hopewell Roads (Figure 1).

Nesting preferences and feeding frequency were monitored for thirteen weeks from late May through early August. Nesting bluebird adults were captured and recorded. If the adult was banded last year, this was noted. Adults were weighed, sexed, measured (for tarsus, wing, and tail lengths), banded, and blood was collected. The same procedures were completed with chicks 12-14 days after hatching. The blood was collected for analysis of parentage as part of Lauren Kordonowy's study. According to developing coloration, the sex ratio of the broods were recorded.

Feeding rate was determined by the frequency within a one-hour period with which the parents returned to the nest to feed the chicks. The duration of their absence, the amount of food with which they returned, and if possible, from where they returned were also recorded. Each nest was monitored 4-6 and 12-14 days after the eggs hatched, to assess how much the parents were able to feed the hatchlings. The need to repeatedly search for food would indicate that resource levels are low or less accessible.

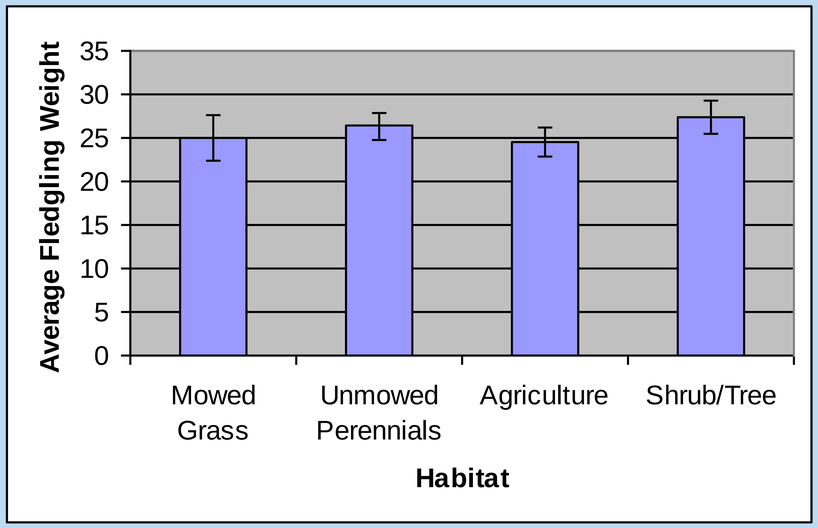

Figure 4: The effect of habitat on average fledgling weight. Error bars represent standard deviation. Parasites did affect weights but parasites were distributed among habitats, explaining some of the variation (ANOVA, F = 1.51, P = 0.271).

Results:

There were sixty-eight chicks in seventeen broods; three died over the course of the project. Twelve broods had blowfly infestations of varying degrees of severity. The proportion of male chicks per brood tended to increase with average nestling weight (Figure 2) but this was not statistically significant. In this analysis we did not include broods with high mortality or blowfly infestation.

Successful boxes were found in all habitat types in which the boxes were set up. Figure 3 indicates which boxes at the BFEC had the most fledglings. Given that birds selected boxes, habitat type did not influence fledgling success (Table 1). Other factors also influence box selection, especially competition with other species in the area (mainly House Wrens and Tree Swallows [personal observation]).

Agricultural fields may not be good sources of food as fledgling weight tended to be low when boxes were adjacent to row crops (Figure 4). This supports published claims that such fields are not prime foraging areas for bluebirds (Gowaty & Plissner, 1998). Although this habitat type seemed to produce smaller chicks, weight was not significantly affected by habitat type overall (Figure 4). Complications to interpreting this include that the foraging radius for adults is wider than their immediate area. For example, the birds at the Simpson's property were seen carrying several berries to their chicks in the middle of a field, but no berry bushes were in seen within 100m of the nest.

Discussion:

The hypothesis that food availability does influence sex ratio was not clearly supported by the positive correlation between chick size and the percentage of males in a brood. Chick weight is a reasonable measure of resource availability because it reflects how much food was available to the chicks. However, the relatively small sample size may make it difficult to detect subtle effects. Nevertheless, L. Kordonowy's results over the last three years indicate that sex ratios have adjusted to how much food was available for chicks (Pers. Comm.).

In the future, it may be useful to compare where returning, previously banded adults choose to live, and whether they choose their old or a new nest, or a similar or different habitat type. It may also be helpful to study the time of season the boxes were first inhabited at the different locations and the extent of occupancy. If one habitat has a higher level of resources than another, that location should have a higher percentage of boxes occupied earlier.

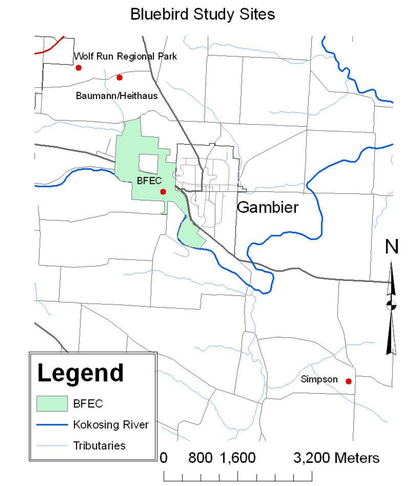

Figure 1

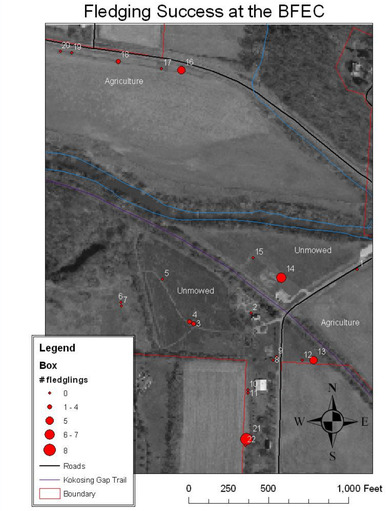

Figure 3

Acknowledgements:

I cannot express enough gratitude to Ray Heithaus for his invaluable guidance; this project would not have been possible without him. I am also indebted to Lauren Kordonowy, my field partner, for her research experience and friendship. Without these two, this project would neither have been as successful nor as enjoyable. Thanks also to Dr. Robert Mauck for training me how to handle, measure, and take blood from the birds. I would also like to thank Kevin Guckes for photographing the birds for us on several occasions and for letting me use his pictures on this poster. The Kenyon College Summer Science Scholars Program generously provided the funding for this project.

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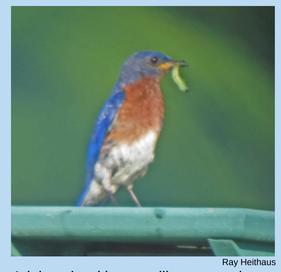

Ray Heithaus

Adult male with caterpillar on nest box.