

**A Study to Determine the Preference of Nesting Box Entrance Hole Size
of *Sialia sialis* (Eastern Bluebird):
Year 2**

**C. A. Burkart¹, A. Russo¹, A. Aldridge², N. Aldridge³, D. Collins², N. Fritzgerld²,
J. Franklin², B. Fraley², A. Greer², L. Hall IV², T. Johnson², R. Kilgore²,
J. D. Lawson², M. Lindsey², G. McKnight², M. Skeens², S. Slempe²,
R. Townsend², N. Woods²**

For a second breeding season, nesting box preference was tested between boxes with large entrance holes and boxes with the traditional entrance hole diameter. As in the previous season, birds (Eastern Bluebirds, chickadees and tree swallows) nesting along the trail at the Powell River Education Center, preferred the boxes with the traditional sized holes; however, there was limited activity in the large holed boxes with one pair of bluebirds successfully fledging four chicks. Bluebirds, tree swallow and chickadees were active in field 1, while only chickadees were active in field 2. Chickadees were the most successful during the 2011 season fledging sixteen chicks, while bluebirds and tree swallows fledged nine chicks each. Chickadees built two nests in field 2, but one nest was abandoned and the second was lost to predation, resulting in the loss of four eggs. By mid-June, the grass in the field 2 has grown tall, and nesting activity ceased. Student volunteers from the general biology classes at Mountain Empire Community College assisted in the replacement of weathered boxes and the monitoring of nesting activity. A student from Lee High School assisted in the placement of the pan traps fulfilling part of his service requirement for an AIMS Scholarship.

¹Biology Department, Mountain Empire Community College, 3441 Mountain Empire Road, Big Stone Gap, VA, 24219.

²Mountain Empire Community College student volunteers.

³Lee High School student volunteer.

Introduction

The 2011 breeding season along bluebird trail established at the Powell River Education Center, boxes with enlarged entrance holes were paired with traditional nesting boxes in order to test whether Eastern Bluebirds had a preference in entrance hole size. The traditional round hole diameter specified by the North American Bluebird Society is 1.5 inches (www.nabluebirdsociety.org/nestboxspecs.htm). In 2002, Bermudez published data demonstrating that Eastern Bluebirds would successfully utilize boxes with entrance holes enlarged to a diameter of 2.75 inches. Competitors such as European Starlings and House Sparrows have been found to avoid boxes with large entrance holes (McGilvrey and Uhler, 1971; Heusmann et. al., 1977). During the 2010 nesting season, one pair each of bluebirds and chickadees utilized the large holed boxes, but only the chickadees were successful in fledging chicks.

Student volunteers from Mountain Empire Community College assisted in trail maintenance, the removal and replacement of tattered boxes along the trail, and the monitoring of nesting activity. N. Aldridge, from Lee High School assisted in the placement of pan traps and nesting box monitoring to fulfill part of his service requirements for an AIMS Scholarship.

Methods

Entrance hole preference- The traditional boxes along the Bluebird trail established at the Powell River Education Center were paired with the boxes of the Bermudez (figure 1a, b). The Bermudez box has a hole diameter of 2.75 (Figure 2a), while the traditional bluebird box has an entrance hole 1.5 inches in diameter (Figure 2b). Nesting boxes were monitored for activity on a weekly basis beginning April 14 through July 21 when it was determined that the last clutch was observed to have fledged. Monitoring activity followed the protocols established by the North American Bluebird Society (Fact Sheet: Monitoring Bluebird Nest Boxes, 2002) and the Virginia Bluebird Society (Virginia Bluebird Trail Monitoring Information, 2004). Data was recorded on forms provided on the Virginia Bluebird Society website.

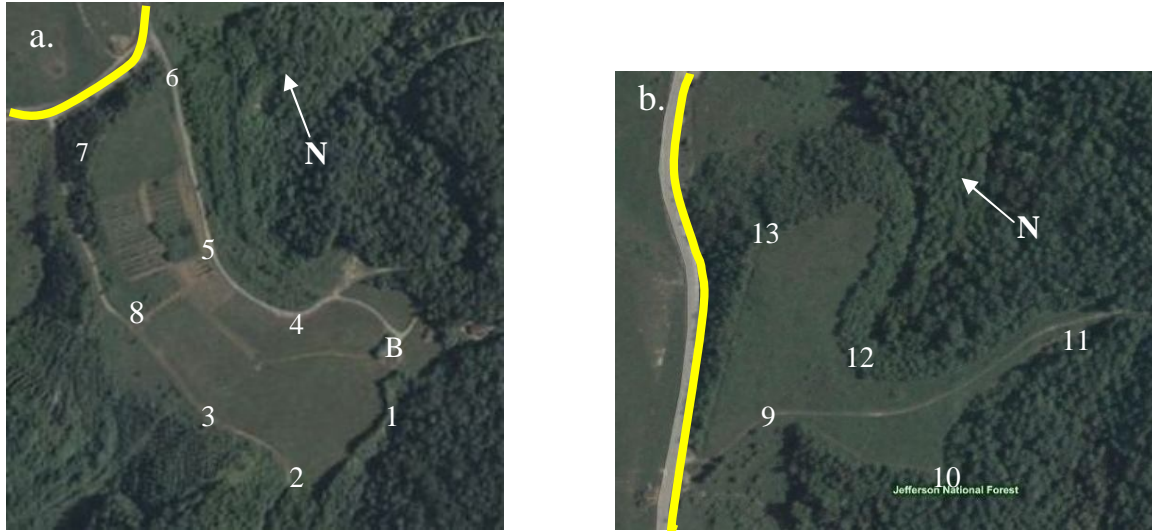


Figure 1. (a) Nesting box sites in field 1 and (b) field 2. Numbers indicate the box locations. Arrow indicates north. The B indicates the position of the barn. Yellow lines indicate the location of the main road. (Image from Microsoft Virtual Earth.)

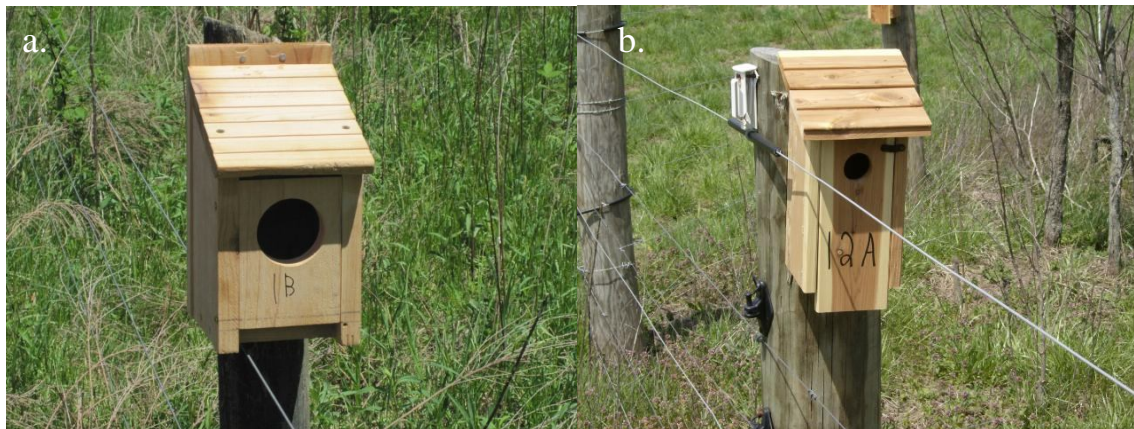


Figure 2. (a) Bermudez nesting box with 2.75 inch diameter entrance hole and (b) traditional nesting box with the 1.5 inch diameter entrance hole.

Survey of insect and invertebrate populations. Grasshoppers, crickets, katydids, beetles, earthworms, spiders, millipedes, sow bugs, and snails make up approximately 68% of the diet of the Eastern Bluebird during the spring and summer months [Fimbel, 2006; Eastern Bluebird (*Sialia sialis*), 1999]. Insects and other invertebrates were only sampled at 4 sites in field 1 (figure 3), because as during the previous season, nesting activity ended in early June in field 2 when the grass grew as much as a meter in height. Pan traps [13 in x 9 in metal cake pans (Terrestrial Arthropod Densities, 1994)] were painted yellow to make them more attractive to insects, and placed outside the fences in case cattle were moved into the field during the sampling period. Pan traps, which passively collect specimens, were placed flush to the ground for seven days. Specimens that entered the traps were captured in a mixture of salt and dish detergent which acts as a temporary preservative (Terrestrial Arthropod Densities, 1994). At the

end of the sampling period, specimens were collected by pouring in specimens through a sieve. Insect nets were used to collect specimens by sweeping the grass along a 30 m x 1 m transects (Perry et al, 2001). Transect sampling was located in areas where the grass was short and bluebirds would most likely hunt (www.bluebirdsforever.com/trail.html). Specimens collected by both techniques were transferred to jars containing 95% ethanol, and at the lab were identified and sorted into groups using the National Audubon Society Field Guides to North American Insects and Butterflies.

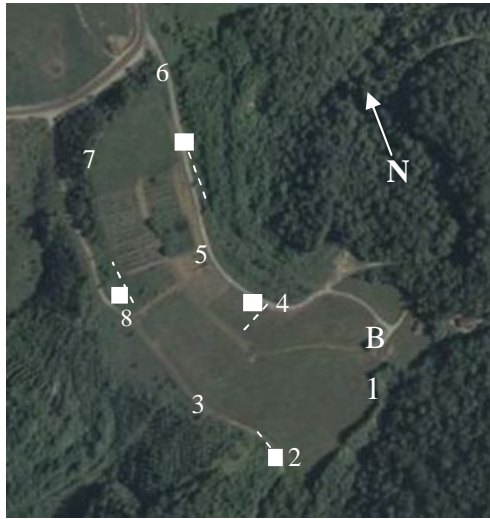


Figure 3. Field 1: Nesting box sites indicated by numbers. Pan sample locations indicated by □'s. Transect locations indicated by dashed lines (----). Arrow indicates north. The B indicates the position of the barn. (Image from Microsoft Virtual Earth.)

Results

Nesting activity: Species active along the trail during the 2011 season included bluebirds, tree swallows and black-capped chickadees (Table 1). Four bluebird eggs were found on April 14 in the small entrance-hole box at site 5 only. Nest building activity was also noted in box 12A (small entrance hole) on that date, and box 8B which is a Bermudez style box; however, no further activity was noted in box 8B. On April 21, chickadee nests were found in boxes 1A, 3A, 7A and 13A, while tree swallows were active in box 4A. One addition egg had been laid in box 5A by this date. No new eggs were laid in any of the nests until April 28, when 5 bluebird eggs were found in box 6A. Total of 9 chickadee eggs were found on May 5 in boxes 3A and 13A, while a total of 12 chickadee eggs and 3 tree swallow eggs were found on May 12 in boxes 1A, 7A and 4A, respectively. The bluebird eggs laid in boxes 5A and 6A hatched by May 12 and the young fledged by June 1. By June 9, the chickadee nestlings in boxes 1A, 3A and 7A had fledged. No new activity was noted in boxes 1A and 3A for the rest of the season. The chickadee eggs in box 13A were lost to predation between May 12 and 19, marking the end of nesting activity field 2.

A second round of nesting occurred in boxes 5A, 7A and 4B (a Bermudez box). One bluebird egg was first observed in box 4B on June 9 and 4 additional eggs had been laid by the next week

(June 14). Of the 5 eggs that were laid, 4 hatched. Despite exposure to heavy rains that soaked the nesting material, all four nestlings were successfully fledged by July 14. Bluebirds also laid 4 eggs in box 7A, but the eggs were lost to predation by July 7. Tree swallows were also active in box 5A on June 23 where 4 eggs were found. Only 3 of the eggs in box 7A hatched. The tree swallows fledged by July 21 marking the end of the nesting season along the trail.

Box	Species	Nest building	# of Eggs	# of Hatchlings	# Fledged
1 A	CH	Yes	6	6	6
1 B	---	No	0	0	0
2 A	---	No	0	0	0
2 B	---	No	0	0	0
3 A	CH	Yes	5	5	5
3 B	---	No	0	0	0
4 A	TS	Yes	6	6	6
4 B	BB	Yes	5	4	4
5 A	BB; TS	Yes	5; 4	5; 3	5; 3
5 B	---	No	0	0	0
6 A	BB	Yes	5	4	4
6 B	BB	Yes	0	0	0
7 A	CH: BB	Yes	5; 4	5; 0	5; 0
7 B	?	Yes	0	0	0
8 A	---	No	0	0	0
8 B	?	Yes	0	0	0
9 A	---	No	0	0	0
9 B	---	No	0	0	0
10 A	---	No	0	0	0
10 B	---	No	0	0	0
11 A	---	No	0	0	0
11 B	---	No	0	0	0
12 A	CH	Yes	0	0	0
12 B	---	No	0	0	0
13 A	CH	CH	4	0	0
13 B	---	No	0	0	0

Table 1. Nesting results for the 2011 nesting season. (A: small box hole; B: large box hole; BB: bluebirds; CH chickadees; TS tree swallows).

Insect and invertebrate survey: Insects and other invertebrates were sampled by net along 30 m transects [July 7 (Table 2)] and by pan trap [June 30-July 7 (Table 3)] at four sites spaced between the 8 boxes in field A. Specimens were identified and placed into one of twenty invertebrate groups using Milne et al. (2005). A total of 2572 specimens were identified in the eight samples collected at the site; a decrease of 725 specimens from the previous year (total of 3301 during the 2010 nesting season (Burkart et al., 2010)). As in previous studies, the largest numbers of specimens were collected by the pan traps; however, there is the possibility that

many specimens were washed out of the pans by heavy rains on the July 6 [0.94 inches at Lonesome Pine Airport (Monthly Weather Planner for Wise VA 24293 www.weather.com)].

SAMPLE	NET 1	NET 2	NET 3	NET 4
Group				
Ants	0	0	0	0
Aphids	0	0	2	0
Bees	7	5	34	4
Beetles	1	1	4	7
Beetle Larvae	1	0	1	2
Crickets	2	7	6	1
Flies	5	19	15	2
Grasshoppers	4	6	4	1
Leafhoppers	75	27	29	11
Millipedes	0	0	0	0
Mosquitoes	0	0	1	1
Moths	0	0	0	0
Sawflies	0	0	0	0
Slugs	0	0	0	0
Snails	0	0	0	0
Spiders	1	7	6	1
Stink Bugs	0	1	0	0
Ticks	0	0	0	2
Wasps	2	3	0	0
Weevils	0	0	1	0

Table 2. Results of insect samples collected by net along 30 m transects on July 7, 2011.

SAMPLE	PAN 1	PAN 2	PAN 3	PAN 4
Group				
Ants	86	28	2	10
Aphids	0	0	0	0
Bees	171	9	16	26
Beetles	24	72	4	42
Beetle Larvae	1	0	1	0
Crickets	12	9	3	15
Flies	167	122	105	281
Grasshoppers	7	26	3	15
Leafhoppers	351	83	56	148
Millipedes	0	0	0	3
Mosquitoes	3	13	1	7
Moths	3	1	1	5
Sawflies	0	1	3	0
Slugs	1	0	3	0
Snails	0	0	1	0
Spiders	101	64	11	17
Stink Bugs	0	0	0	0
Ticks	1	1	0	1
Wasps	10	1	5	6
Weevils	0	0	0	0
Unknown	16	25	15	36

Table 3. Results of pan samples collected during the week of July 7-14, 2011.

Discussion

Just as Bermudez reported in 2002, over the past two breeding seasons we found that both bluebirds and chickadees will utilize and successfully fledge young from nesting boxes with entrance holes enlarged to a diameter of 2.75 inches. However, the birds overwhelmingly chose the boxes with the traditional holes over the Bermudez boxes. During the 2010 and 2011 seasons, a total of 19 clutches for a total of 93 eggs were laid in boxes with the traditional-hole size, while only 3 clutches totaling 12 eggs were laid in the Bermudez boxes. Nesting data collected during the combined breeding seasons indicated that bluebirds, as well as black-capped chickadees and tree swallows overwhelmingly preferred the boxes with the traditional-hole size over the boxes with the enlarged-hole (figure 4).

While there was a decrease in the number of insects and other invertebrates collected during the 2011 season, the preferred food items for bluebirds [beetles, butterflies, crickets, grasshoppers, leafhoppers, moths and spiders (All About Birds- Eastern Bluebird, 2003)] were still abundant

along the trail. No butterflies were collected during the 2011; however, combined totals of preferred food items from both sampling techniques at each sampling site made up 49.5% of the

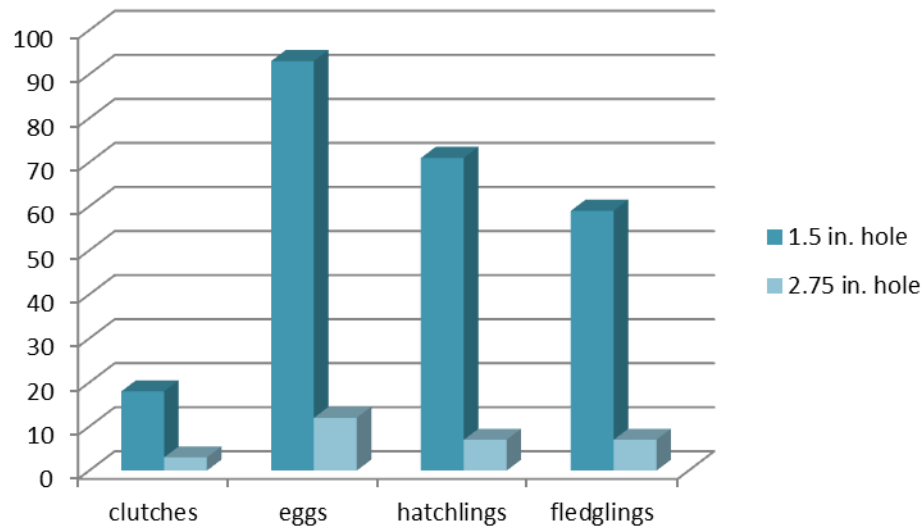


Figure 4. Comparison of combined data for the 2010-2011 seasons. Data includes the number of clutches, eggs laid, hatchlings and fledgling found in the boxes with the traditional 1.5 inch diameter hole and Bermudez boxes with 2.75 inch diameter holes.

specimens sampled. As noted above, a possible reason for the decrease in the number of insects was the heavy rain storm that came through the area the day before the pan samples were pulled and the transect samples collected. A total of 0.94 inches of rain fell at Lonesome Pine Airport on July 6 (Monthly Weather Planner for Wise VA 24293 www.weather.com), which would have been sufficient to overflow pans that are about 2 inches deep. Despite the decrease in the number of invertebrate specimens collected, it is obvious that sufficient food was present along the trail to support the production of 49 eggs and the fledging of 38 chicks by the three species combined. While the number of eggs decreased from a total of 56 to 49 from the 2010 (Burkart et. al. 2010) to the 2011 season, the number of fledglings increased from 28 (Burkart et. al. 2010) to 38 from 2010 to 2011, respectively. That is an increase in fledging success from 50% in 2010 to 78% in 2011.

As during the previous breeding seasons, the bluebird trail at the Powell River Educational Center successfully supported the reproductive efforts of Eastern Bluebirds, chickadees and tree swallows. During the 2010-11 seasons when the Bermudez boxes were tested against the traditional boxes, both bluebirds and chickadees were found to utilize the Bermudez boxes. However, given the choice, birds overwhelmingly chose the boxes with the traditional 1.5 inch hole diameter.

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