

**Nesting Results and Habitat Assessment of the
Nesting Box Trail for *Sialia sialis* (Eastern Bluebird)
In the Powell River Project Education Center
Year 3: Addition of Awnings to Open-topped Boxes**

**C. A. Burkart¹, A. Russo¹, T.J. Davis², D. Hall², S. Helbert², M. Jones²,
and A. Thacker²**

Abstract

Awnings were added to the open-topped boxes during the 2009 breeding season along the bluebird nesting box trail at the Powell River Education Center to decrease daytime temperatures in the boxes by providing shade, while allowing in the elements to deter competitors. During the 2009 nesting season (late March to mid-July), nesting activity, as in the previous two seasons was limited to the closed top boxes. Bluebirds and chickadees were active in field 1 and successfully fledged young. Bluebirds and tree swallows were active in field 2, but none of the nests were successful in fledging any young. During this season, a total of nine bluebirds and fifteen chickadees were fledged; neither of the tree swallows nests were successful. Student volunteers from the Mountain Empire Community College assisted in monitoring the boxes and counting insect samples.

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

²Mountain Empire Community College student volunteers.

Introduction

During the third year of the project along the bluebird trail established at the Powell River Education Center, open-topped boxes were modified by adding an awning to reduce the amount of sunlight that entered the boxes. The hypothesis behind the modification was that the addition of the awnings would reduce the internal box temperature (especially during the second half of the season) and make the boxes more attractive to the birds while maintaining the open box design. In addition to the attachment of awnings, the directions with respect to compass points that box openings faced were determined for each box. Student volunteers from Mountain Empire Community College monitored the nesting activity and analyzed insect samples. It was hoped that there would be increased nesting activity from the previous year in order to test for a preference in box design.

Methods

Nesting box preference- The objective of this study was to test whether bluebirds have a preference for the open or closed topped boxes. Each nesting box site consisted of two boxes. One box was the traditional design with the closed top (Figure 1a). The second box was the open topped design with an awning attached to block the sun while still allowing rain to enter the box (Figure 1b). This box design is similar to the design that was found to be successful in deterring competitors in a Wisconsin study (Bauldry, 1995).

Orientation of box openings were determined by compass. Dhondt and Phillips (2001) suspected that box preference would be affected by the prevailing direction of storms and for the avoidance of the afternoon sun.

a.



b.



Figure 1. (a) Closed and (b) open topped nesting box with awning.

Boxes were monitored for activity on a weekly basis between March 31 and July 14, 2009 following 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, 2006). Data was recorded on forms provided on the Virginia Bluebird Society website.

Survey of insect and invertebrate populations. Insects and other invertebrates were sampled using passive pan traps, and insect nets along 30 m transects. Sample sites are indicated in figures 2 and 3. Pan traps were placed outside the fences to prevent injury to cattle. Transect sampling took place inside or along the fence lines. Pan traps consisted of 13 in x 9 in metal cake pans sprayed yellow to attract

a large variety of insects (figure 5a; Terrestrial Arthropod Densities, 1994), and placed flush with the substrate. The pans were filled with a soap and salt solution, which acted as a trap and as a temporary preservative. The traps remained in place for seven days after which specimens were collected by pouring the contents of the pan through a strainer. The specimens were rinsed and placed in 95% ethanol. Animals were also collected along 30 m transects by sweeping vegetation with an insect net (figure 5b; Perry et al, 2001), and transferred to a jar containing 95% ethanol. Specimens 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.)



Figure 4. Field 2: Nesting box sites indicated by numbers. Pan sample locations indicated by □'s. Transect locations indicated by dashed lines (----). Arrow indicates north. (Image from Microsoft Virtual Earth.)

a.



b.



Figure 5. (a) Pan sample between boxes 5 and 6 after one week; (b) A. Russo collecting specimens along the 30 m transect line by boxes 8 A and B.

Results

Nesting activity: For a third year in a row, bluebirds, tree swallows, and for the first time black-capped chickadees limited their nesting activities to the closed top boxes (Table 1). The first bluebird eggs were found along the trail on April 9 in box 3A and 8A. Four additional eggs were laid in box 3A by the following week. Four of the five eggs hatched by May 7 and all of the chicks fledged by the time the box was checked on May 19. No additional activity was noted in the box the rest of the season. Two bluebird eggs were found in box 8A on April 9, but the eggs disappeared by the next week lost to an unknown predator. A single bluebird eggs was found in the nest on May 7; however, it was abandoned.

Box	Species	Nest building	# of Eggs	# of Hatchlings	# Fledged
1 A	CH, BB	complete	0	0	0
1 B	--	--	0	0	0
2 A	CH	complete	6	6	6
2 B	--	--	0	0	0
3 A	BB	complete	5	4	4
3 B	--	--	0	0	0
4 A	CH	complete	5	3	3
4 B	--	--	0	0	0
5 A	BB	complete	8	7	4
5 B	--	--	0	0	0
6 A	--	--	0	0	0
6 B	--	--	0	0	0
7 A	CH	complete	6	6	6
7 B	--	--	0	0	0
8 A	BB	complete	3	0	0
8 B	--	--	0	0	0
9 A	TS	complete	5	0	0
9 B	--	--	0	0	0
10 A	TS	complete	5	5	0
10 B	--	--	0	0	0
11 A	--	--	0	0	0
11 B	--	--	0	0	0
12 A	BB	complete	6	5	0
12 B	--	--	0	0	0
13 A	--	--	0	0	0
13 B	--	--	0	0	0

Table 1. Nesting results for the 2009 nesting season. (A: closed top box; B: open top box; BB: bluebirds; CH chickadees; TS tree swallows).

Eggs were found in four boxes (2A, 5A, 10A and 12A) on April 28. Six chickadee eggs were laid in 2A. These eggs later hatched and all the chicks fledged (figure 6 a). The eggs in box 5A were laid by bluebird; four of the five eggs hatched but only one of the hatchlings fledged. The cause of death was unknown; however, the nest was infested with ants. There was a significant increase in the ant population in the sample collected near box 5A [142 ants in 2009 compared to 14 ants in 2008 (Burkart et al., 2008)]. Ants were a problem in many of the boxes along the fence line around both fields. When disturbed, the ants were highly aggressive. One investigator was bitten while doing maintenance on a box (A. Russo, per. comm.). Five tree swallow eggs were found in box 10A and successfully hatched, but were lost before the next monitoring to an unknown predator. A bluebird laid eggs in box 12A. All eggs hatched (figure 6 b), but the chicks were found dead on the May 12 monitoring trip. Cause of death was unknown, but it is possible that the parents were killed during a strong thunderstorm that moved through the area. On May 8, a long-lived supercell thunderstorm

moved through Wise Co. causing the National Weather Service in Morristown TN to issue a tornado warning. It was later determined that an EF2 tornado touched down in the county around 9:45 pm EDT (National Weather Service Forecast Office, 2009).

a.



b.



Figure 6. (a) Black-capped Chickadee nest containing chicks within days of fledging. (b) Bluebird nest containing two day old chicks. Note the difference in nests; bluebirds make a cup-shaped nest from dried grass while chickadees build a foundation of moss and make a cup of dried grass lined with fur and feathers.

On May 7, six chickadee eggs were found in box 7A, while one bluebird egg was found in box 8A. All six of the chickadee eggs hatched and successfully fledged, while the bluebird egg was abandoned.

Five chickadee eggs were present in box 4A on May 19. Only three of these eggs hatched and all nestlings fledged. Tree swallow eggs were found in box 9A on May 28, but were lost to an unknown predator by the next week.

The last nesting of the season was in box 5A. A female bluebird was actively sitting on the nest on June 24. The number of eggs was not determined at that time, because we did not want to chase the female from the nest. Three hatchings were later found in the nest and successfully fledged.

Insect and invertebrate survey: Insects and other invertebrates were sampled by two methods [insect net and pan trap (Tables 2 and 3)]. A total of 6681 specimens were identified. As in the previous years, the largest numbers of specimens were collected by the pan traps. Specimens were identified and placed into one of twenty-six invertebrate groups using Milne et al. (2005). In addition to the invertebrates, a salamander was collected in pan trap 6.

30 m Transects

Group	Sample	Field 1				Field 2	
		1	2	3	4	5	6
Ants		0	1	0	0	0	6
Aphids		0	8	3	0	0	23
Bees		58	51	22	3	118	96
Beetles		9	29	3	2	39	72
Butterflies		0	3	0	0	3	2
Caterpillars		0	0	0	0	0	3
Centipedes		0	0	0	0	0	0
Crickets		17	1	4	4	17	12
Diplurian		0	0	0	0	0	1
Dragonflies		1	0	0	0	0	0
Earwigs		0	0	0	0	0	0
Flies		7	3	12	3	9	38
Grasshoppers		2	20	3	0	18	26
Lacewing		0	0	0	0	0	0
Leafhoppers		166	102	58	14	86	71
Long-legged seed bug		0	3	0	0	1	1
Millipedes		0	0	0	0	0	0
Mosquitoes		0	7	7	4	1	4
Moths		0	2	0	0	0	1
Mill bugs		0	0	0	0	0	0
Roach		2	0	0	0	0	0
Sawflies		0	0	0	0	0	0
Slugs		0	0	0	0	0	0
Snails		0	1	0	0	1	0
Spiders		13	25	24	3	16	49
Ticks		0	0	0	0	0	0
Wasps		2	3	3	2	4	2
Weevils		0	3	0	0	5	10

Table 2. Results of insect and invertebrate transect surveys conducted July 21 (field 1) and July 28 (field 2), 2009.

Group	Pan Traps						
	Sample	Field 1				Field 2	
		1	2	3	4	5	6
Ants	29	49	142	17	28	30	
Aphids	2	0	4	0	6	0	
Bees	187	572	342	73	35	102	
Beetles	20	39	55	29	64	27	
Butterflies	2	2	2	6	10	0	
Caterpillars	0	0	1	0	1	0	
Centipedes	2	0	0	1	0	0	
Crickets	7	40	31	13	19	28	
Diplurian	0	0	0	0	0	0	
Dragonflies	8	0	0	0	0	0	
Earwigs	6	22	27	0	0	4	
Flies	64	62	78	70	105	149	
Grasshoppers	16	2	7	10	5	13	
Lacewing	0	1	0	0	3	0	
Leafhoppers	335	526	489	192	165	310	
Long-legged seed bugs	0	0	0	1	2	2	
Millipedes	0	0	0	0	0	0	
Mosquitoes	78	15	6	2	1	3	
Moths	0	25	27	0	0	7	
Mill bugs	0	0	0	1	0	0	
Sawflies	0	27	4	0	6	12	
Slugs	11	2	19	4	0	0	
Snails	0	0	0	0	4	5	
Spiders	27	29	76	12	18	25	
Ticks	0	0	4	0	0	0	
Wasps	0	17	3	37	8	20	
Weevils	0	0	0	0	6	0	

Table 3. Results of insect and invertebrate pan surveys conducted between July 21 and 28 (field 1) and July 28 and August 4 (field 2), 2009.

Nesting activity and nesting box bole orientation: Box orientation according to the compass points was considered when the trail was setup; however, the final orientation of the boxes was determined by position of the wire on the post and the need to keep the boxes on the outside of the fence and away from cattle. Half of the boxes faced southwest, south-southwest or west-southwest (table 4). Three of the boxes faced south, and two boxes faced west. Boxes 6A and 6B were the only boxes that faced north, while the remaining boxes faced east, southeast and northeast.

Field 1		Field 2	
box	compass reading	box	compass reading
1 A	224°	9 A	240 °
1 B	224°	9 B	125 °
2 A	219°	10 A	286 °
2 B	219°	10 B	207 °
3 A	235°	11 A	245 °
3 B	235°	11 B	45 °
4 A	208°	12 A	170 °
4 B	220 °	12 B	170 °
5 A	180 °	13 A	86 °
5 B	180 °	13 B	175 °
6 A	347 °		
6 B	347 °		
7 A	268 °		
7 B	270 °		
8 A	236 °		
8 B	248 °		

Table 4. Nesting box hole orientation for the bluebird boxes along the Powell River Project.

Discussion: From the results of three seasons of nesting activity, it can be concluded that the bluebirds, as well as tree swallow and black-capped chickadees that nested at the Powell River Educational Center preferred closed topped nesting boxes over the open design. The addition of the awning to reduce sunlight and the internal temperature in the open topped boxes, especially during the latter half of the season, did not appear to make the boxes more attractive to the three species of birds. Nesting patterns at the various sites were not be strongly influence by the type of food found near each site; the preferred food items for bluebirds [beetles, butterflies, crickets, grasshoppers, leafhoppers moths and spiders (All About Birds- Eastern Bluebird, 2003)] made up between 49.9% and 57.3% of the groups present in the combined tallies at each sampling site.

The most successful boxes, as determined by clutches that resulted in fledglings, were oriented either directly south or somewhere between south and west (table 4). Dhondt and Phillips (2001) suggested that nests that did not get the afternoon sun and faced in the opposite direction of prevailing storms had the highest fledging rates. The most successful boxes, with the exception of box 7A, did not face directly west. This box was shaded from the direct rays of the afternoon sun by a strand of pine tress. In addition, the most successful boxes were facing away from the storms that come in from the northwest out of Kentucky.

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