# A Study to Determine the Preference for Nesting Box Design of *Sialia sialis* (Eastern Bluebird), *Tachycineta bicolor* (Tree Swallow) and *Poecile atricapillus* (Black-capped Chickadee): Comparison of the Traditional Nesting Box and the Peterson Box
## Year 3

**C. A. Burkart[1], A. Russo[1], T. Adkins[2], A. Blanton[2], K. Burke[2], H. Calhoun[2], M. Crabtree[2], S. Deaton[2], S. Etter[2], M. Fields[2], D. Franklin[2], C. Garrett[2], K. Green[2], L. Hall[2], K. Hatley[2], L. Hobbs[2], A. Hofemeister[2], K. Honaker[2], M. Megen[2], J. Key[2], A. Kyle[2], K. Lawson[2], L. Lyke[2], R. Maggard[2], B. Mead[2], M. Miles[2], S. Price[2], N. Sandhu[2], J. Smith[2], A. Stanley[2], A. Stapleton[2], W.Sturgill[2], K. Taylor[2], J. Tippett[2]**

The 2014 nesting season was the third and final year of our study comparing the Peterson box to the traditional rectangular bluebird nesting box. Unlike the traditional boxes, Peterson boxes are wedge shaped, decreasing the internal volume of the box and the amount of material required to build a nest. The idea behind the Peterson design is that the number of young fledged per nest will be higher over the traditional design. By reducing the energy required for nest building, more energy would be available for rearing young. As during the previous season, bluebirds, tree swallows and chickadees utilized the Peterson boxes. During the 2014 season, nest building activity was equally distributed between the two types of boxes (8 and 9 partial or complete nests in traditional and Peterson boxes, respectively). However, the pattern of egg laying activity shifted from the first season, with bluebird only laying eggs in Peterson boxes; while chickadees and tree swallows laid eggs in both box types. The number of eggs laid, hatching success and fledging were not enhanced by the Peterson design. Three seasons of data was pooled by species and across species. Differences were not found to be significant, with the exception of bluebird egg production. Average bluebird clutch size was higher for the traditional box than for the Peterson box. As in previous season, student volunteers from Mountain Empire Community College performed maintenance along the trail and assisted in the monitoring of nesting activity.

---

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

[2]Mountain Empire Community College student volunteers.

## Introduction

The 2014 nesting season at the Powell River Education Center was the third and final year of testing with the Peterson Box design. The Peterson box was developed and modified by Dick Peterson (Berner, 1994), with the objective of increasing fledgling success by reducing the amount of energy adults would need to invest in nest building. The Peterson design has a slant roof and front, resulting in a smaller internal volume and a reduction in the amount of material required to build a complete nest. Reducing the amount of energy required for nest building would mean more energy available to feed and care for the chicks, thus increasing fledgling success (Bluebird Nest Box Styles: Pros and Cons, 2010). The Peterson design also differs in the size and shape of the opening. The Peterson box has an oval opening rather than the round hole used in the traditional box. It was suggested that the larger opening would allow the adults to care for the chicks without completely entering the box (Berner, 1994). Other possible advantages of the Peterson design suggested in the literature include: better protection from rain, reduction in internal temperature fluctuations, and reduced exposure to predators (Berner, 1994; Bluebird Nest Box Styles: Pros and Cons, 2010).

As in previous years, student volunteers from Mountain Empire Community College assisted in the monitoring of nesting activity, as well as, brush and weed removal and replacement of damaged boxes.

## Methods

*Box design preference and clutch success*: Thirteen nesting sites were distributed around two fields (figure 1 a, b), with each site consisting of one traditional rectangular box (figure 2a) and a Peterson box (figure 2b). Boxes were nailed to posts along the fence lines, and when possible, both types of boxes were attached to posts facing the same direction. Monitoring began April 9, and continued on a weekly basis until nesting activity was no longer observed (July 8).

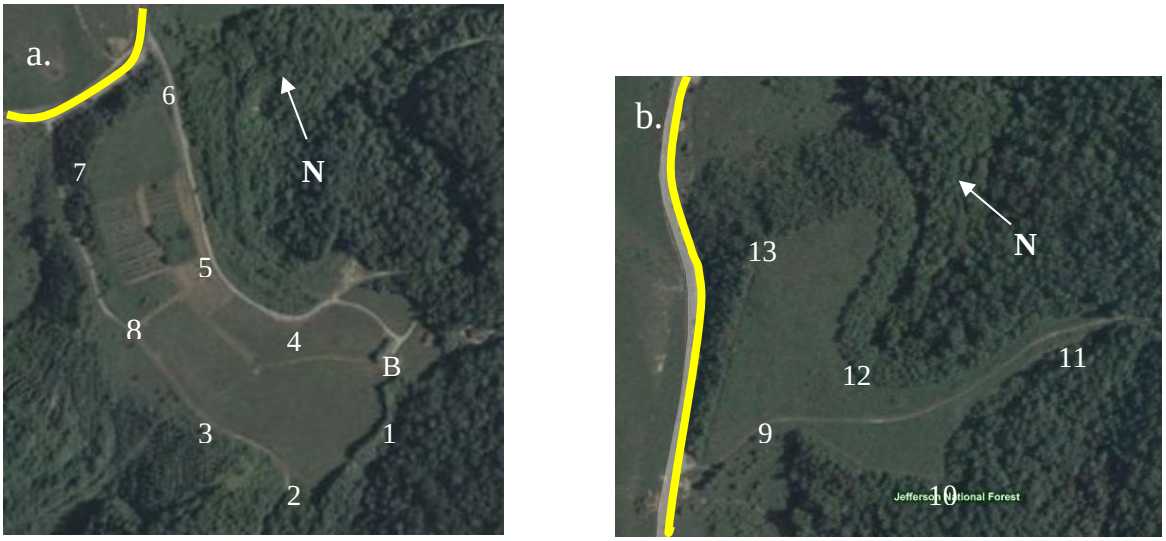


Figure1. (a) Nesting box sites in field 1 and (b) field 2. Numbers indicate the box locations. Arrow indicates north. The B indicates the position of the barn. Yellow lines indicate the location of the main road. (Image from Microsoft Virtual Earth.)

a.  b. 

Figure 2. (a) Traditional rectangular nesting box (B. Meade), and (b) and a Peterson box (L. Hall).

Monitoring activity followed the protocols established by Virginia Bluebird Society (Virginia Bluebird Trail Monitoring Information, 2004) and the North American Bluebird Society (Fact Sheet: Monitoring Bluebird Nest Boxes, 2002). Data was recorded on forms downloaded from the Virginia Bluebird Society website. Data collected included partial and completed nests, species identity, number of eggs, number of young, condition of young (recently hatched, feather development, etc.) and number of young fledged. Condition of the boxes was also noted, including the presence of ants, wasps, spiders or mice.

## Results

*Nesting activity:* As in the 2013 season, nest building had begun in several boxes by the date of the first monitoring visit (April 9), and bluebird eggs were found in box 5B the following week (April 16). The heaviest nesting activity occurred during May. The last activity for this season was on July 8 at sites 4 and 5, located in field 1 on either side of the mowed section of the field.

Eastern Bluebirds, Tree Swallows and Black-capped Chickadees were again active during the 2014 season; however, this season tree swallows failed to fledge chicks. Tree swallows laid a total of 19 eggs in 4 nests [2 clutches in traditional boxes (4A and 5A) and 2 in Peterson boxes (4B and 8B)], but all eggs disappeared from the nests before they hatched (table 1). The Black-capped Chickadees produced 3 clutches for a total of 18 eggs, all of which hatched and the chicks successfully fledged. One pair used Peterson box 6B and produced 7 eggs, while the two pairs that used the traditional boxes (sites 2 and 3 at the southern end of field 1) produced clutches of 5 and 6 eggs, respectively (table 1). Bluebirds produced 21 eggs between 6 clutches, and unlike the previous two seasons, all clutches were laid in Peterson boxes. Two clutches of eggs were lost to predation, both clutches from box 7B. A third clutch of 4 eggs produced in this box successfully hatched and fledged. Two clutches were produced in box 5B. Both clutches contained 5 eggs, but while the first clutch successfully fledged 5 eggs, the second clutch had only 2 of the 5 eggs hatch. Both of these chicks were successfully fledged. The final clutch of eggs was laid in box 10B located in the southern-most corner of field 2. This was the only active

nest in field 2. The clutch contained 2 eggs, both of which hatched and later fledged.

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

Table1. Nesting results for the 2014 nesting season. (A: traditional nesting box; B: Peterson nesting box; BB: Bluebirds; CH Chickadees; TS Tree Swallows; ? grass nests produced by undetermined builders). Sites 1-8 are in field 1. Sites 9-13 are in field 2. *Eggs or chicks lost to predators.

## Discussion

*Nesting box preference:* The 2014 nesting season was the final year of testing for the Peterson boxes. Black-capped Chickadees and tree swallows utilized both the Peterson and traditional boxes. Berner (1994) reported that bluebirds demonstrated a preference for the Peterson boxes, and during the 2014 season, bluebirds utilized the Peterson boxes exclusively. Over the course of the three breeding seasons, nesting activity by bluebirds shifted from the traditional design (6 out of 7 clutches in traditional boxes in 2012) to that of the Peterson boxes in 2014 [6 out of 6 clutches in Peterson boxes (figure 3)]. Berner (1994) also reported that tree swallows

demonstrated a preference for the Peterson design, but they did not exhibit the same trend during this study. Tree swallow nests increased from 2 to 4 clutches for 2012 and 2014, respectively. Tree swallows laid 2 clutches in Peterson boxes each year, with the additional clutches laid in the traditional boxes (figure 3). Chickadees demonstrated the opposite behavior from the bluebirds, producing 3 of the 4 clutches in Peterson boxes during the 2012 season, while producing 1 of 3 in Peterson boxes in 2014 (figure 3).

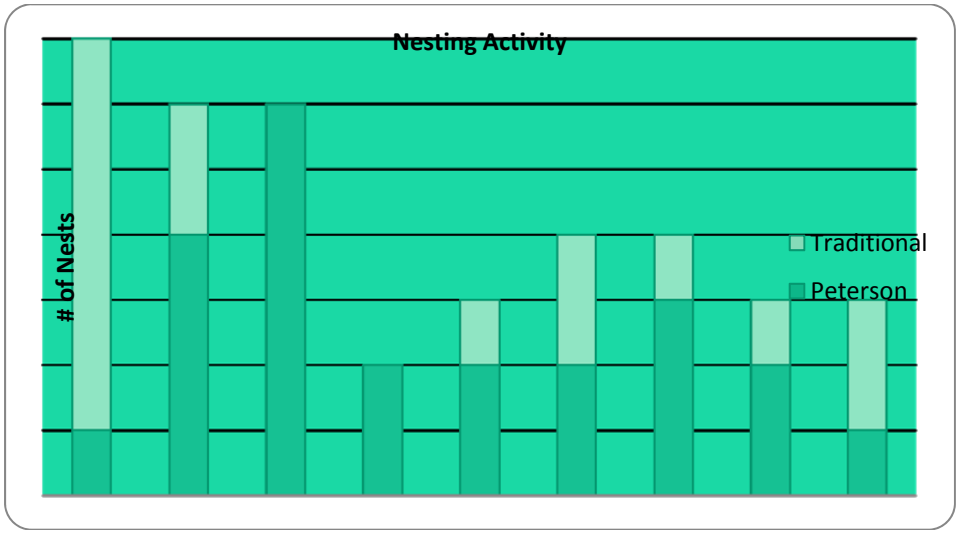


Figure 3. Number of clutches per nesting box design by year and by species.

*Predation:* Predation continues to impact hatching success and fledging during the 2014 season as it has in the previous seasons along the trail (Burkart et. al, 2007, 2008, 2009, 2010, 2011, 2012, and 2013). While chickadees experienced the highest rate of predation during the previous season (Burkart et. al, 2013), tree swallows suffered the greatest loss during the 2014 season. Of the 18 tree swallow eggs produced in the 4 clutches, all were lost to predators (figure 4). Two of the 3 bluebird clutches in box 7B (a Peterson box) were lost, most likely to predators (figure 5), which resulted in the loss of 5 eggs. Chickadees were the only species not to lose eggs or chicks (figure 6). Despite the claim that the Peterson design may provide better protection from predators (Berner, 1994; Bluebird Nest Box Styles: Pros and Cons, 2010), this study did not find it to be true.

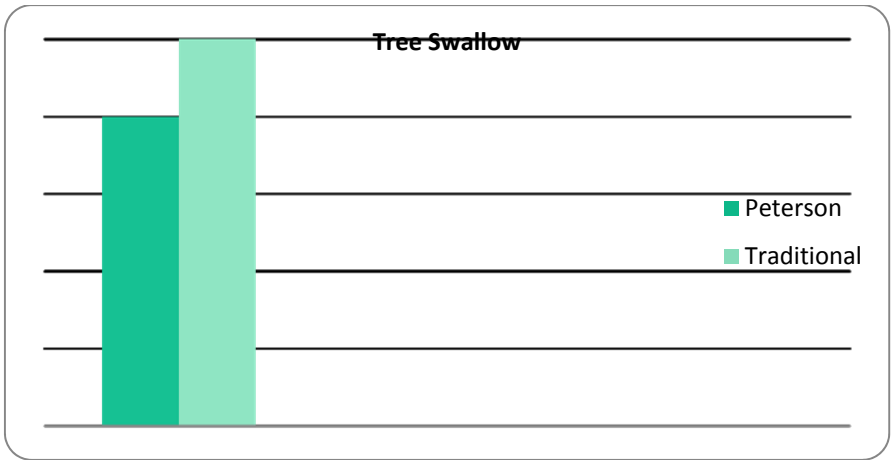


Figure 4. The number of tree swallow eggs produced, eggs hatched and chicks fledged.

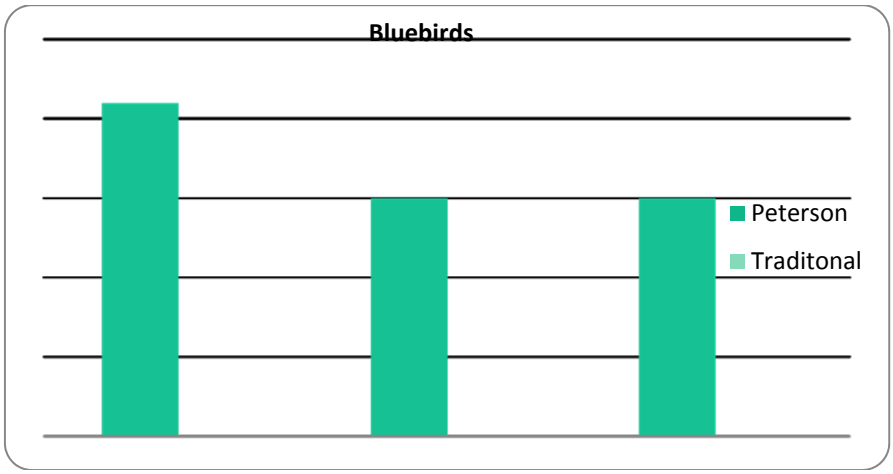


Figure 5. The number of bluebird eggs produce, eggs hatched and chicks fledged.

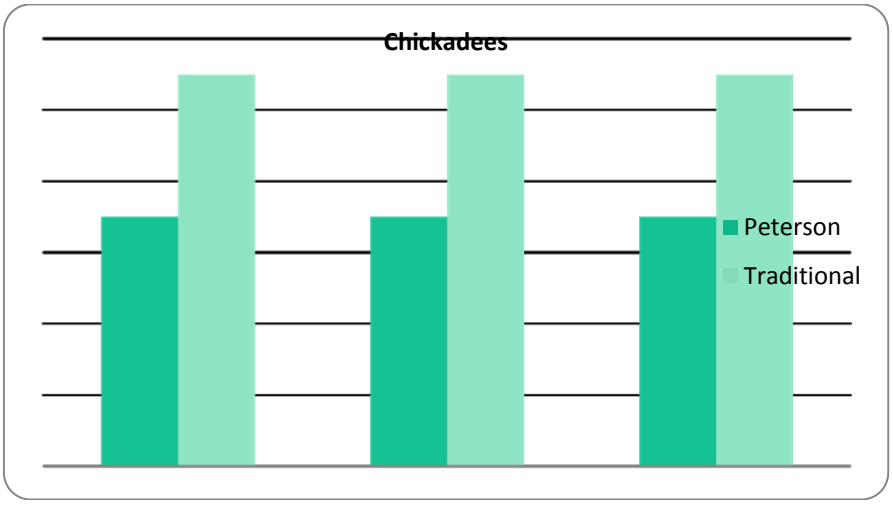


Figure 6. The number of chickadee eggs produced, eggs hatched and chick fledged.

*Egg production, hatching success and fledging success*: Two tailed Students T-tests were run on the combined data set from the 2012, 2013 and 2014 seasons. When T-tests were run on egg production rates, eggs hatched and chicks fledged (across species), differences between the averages for the traditional and the Peterson design were not significant ($p$ values of 0.2734, 0.5873 and 0.7155 for egg production, eggs hatched and chicks fledged, respectively). When the same parameters were tested with regard to species, average egg production rates did not differ significantly for chickadees ($p$ = 0.8345) or tree swallows ($p$ = 0.8926). Egg production differed significantly for bluebirds between the two box designs ($p$ = 0.0405), with bluebirds producing an average of 4.9 ($\pm$ 0.4) eggs/clutch in the traditional boxes, but only 3.8 ($\pm$ 1.4) eggs/clutch in Peterson boxes. Bluebirds may have shown an increasing preference for the Peterson boxes over the three year period, but egg production rates were not enhanced by the design. Hatching success and the numbers of chicks fledged did not differ significantly between the two designs for any of the species.

*Conclusion*: Peterson nesting boxes were utilized by bluebirds, tree swallow and chickadees during the three seasons of this study. Bluebird usage dramatically shifted over the course of the three seasons, with all but one clutch laid in the traditional box during season 1 to all clutches laid in the Peterson design during season 3. Tree swallows and chickadees at the site did not demonstrate the same pattern. Advantages of the Peterson design over the traditional design were not demonstrated by the study. The data did not indicate an enhancement in fecundity, in fact for bluebirds, the number of eggs/clutch decreased with the Peterson design. In addition, the Peterson design did not appear to provide any additional protection from predators over that provided by the traditional nesting box design.

## **Literature Cited**:


Berner, K. L. The Peterson Box (1994). Retrieved August 13, 2012. http://www.nysbs.org/handouts/ThePetersonBox.pdf.

Bluebird Nest Box Styles: Pros and Cons (2010). Retrieved April 4, 2011. http://www.sialis.org/nestbox proscons.htm.

Bluebird Trail Monitoring Information (2004). Virginia Bluebird Society. Retrieved March 29, 2006 from http://www.virginabluebirds.org/pages/monotor1.html.

Burkart, C.A., A. Russo, J. Church, G. Brooks, J. Collins, S. Collins, A. Christian, M. Head, A. Rutherford, and Evan Reynolds, 2007. Nesting Results and Initial Habitat Assessment of the Nesting Box Trail for Sialia sialis (Eastern Bluebird) In the Powell River Project Education Center. Powell River Project Research and Education Program Report 2007. Pp. 13-21.

Burkart, C. A., A. Russo, L. Clayton, T.J. Davis, V. Fleming, J. Genco, S. Lane and J. Mays, 2008. Nesting Results and Initial Habitat Assessment of the Nesting Box Trail for *Sialia sialis* (Eastern Bluebird) In the Powell River Project Education Center Year 2: Expansion. Powell River Project Research and Education Program Report 2008. Pp. 24-34.

Burkart, C. A., A. Russo, T.J. Davis, D. Hall, S. Helbert, M. Jones, and A. Thacker, 2009. 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. Powell River Project Research and Education Program Report 2009. Pp. 62-71.

Burkart, C. A., A. Russo, J. Barnette, N. Hamilton, S. Helbert, J. Ingle, G. Joseph, M. Moore, Y. N. Owens, T. Rose, B. Smith, N. Ward, B. Wells, T. Young, 2010. A Study to Determine the Preference of Nesting Box Entrance Hole Size of *Sialia sialis* (Eastern Bluebird). Powell River Project Research and Education Program Report 2010. Pp. 1-9.

Burkart, C. A., A. Russo, A. Aldridge, N. Aldridge, D. Collins, N. Fitzgerald, J. Franklin, B. Fraley, A. Greer, L Hall IV, T. Johnson, R. Kilgore, J.D. Lawson, M. Lindsey, G. McKnight, M. Skeens, S. Slemp, R. Townsend, N. Woods, 2011. A Study to Determine the Preference of Nesting Box Entrance Hole Size of *Sialia sialis* (Eastern Bluebird): Year 2. Powell River Project Research and Education Program Report 2011. Pp. 1-7.

Burkart, C. A., A. Russo, W. Baker, M. H. Belcher, B. Brown, J. Collins, N. Crouse, A. Dickenson, H. Dotson, T. Evans, B. Funk, A. Goforth, L. Hall, S. Helbert,L. Hobbs, K. Ingle, S. Jessee, J. McDaries, B. Mullins, C. Odle, E. Orndorff, C. Page, K. Pilkenton, T. Price, S. Smith. 2012. A Study to Determine the Preference for Nesting Box Design of *Sialia sialis* (Eastern Bluebird): Comparison of the Traditional Nesting Box and the Peterson Box: Year 1. Powell River Project Research and Education Program Report 2012. Pp. 29-35.

Burkart, C. A., A. Russo, C. Meade, D. Hubbard, C. Phillips, T. Yates, H. Lipps, E. Lambert, C. Moles, K. Flanary, S. Head, D. Williams, C. Engle, A. Huneycutt, L. Oquinn, L. Owens, M. Steele, J. Reinhard, A. Maine, C. Dean, F. Croley, C. Gaiger, T. Younce, A. Bourn, M. Short, S. Mullins, A. Fields, A. Stidham, D. Hamilton, K. Green, A. Nash, Z. Cooper, H. Tate, M. DeBoard, A. Adams, S. Kern, T. Turner, C. Greer, W. Beaver. A Study to Determine the Preference for Nesting Box Design of *Sialia sialis* (Eastern Bluebird): Comparison of the Traditional Nesting Box and the Peterson Box: Year 2. Powell River Project Research and Education Program Report 2013. Pp. 39-46.

Fact sheet: Monitoring Bluebird Nest Boxes (2002). North American Bluebird Society. Retrieved March 1, 2006 from http://www.nabluebirdsociety.org/monitor.htm.