Project SOS (Save Our Sialia)

A report based on data collected and tabulated by volunteers Bob and Judy Peak during the 2019 Eastern Bluebird nesting season for the USDA-Forest Service, the Friends of Land Between the Lakes, and the Kentucky Department of Parks

Description of Bluebird Trail Locations

Primary Location:

Land Between the Lakes, also sometimes simply referred to as LBL, is a 170,000-acre National Recreation Area located in western Kentucky and Tennessee. LBL is a 40-mile long peninsula that was formed when the Tennessee River and Cumberland River were impounded, creating Kentucky Lake and Lake Barkley (respectively). (Note: The lakes are connected by a mile-long canal on the north end of LBL.) In 1963, President John F. Kennedy designated these federal lands as **Land Between the Lakes National Recreation Area (LBLNRA)**. The project was intended to demonstrate how an area with limited amounts of timber, agricultural resources, and industrial resources could be converted into a recreation asset that would stimulate economic growth in the region. Today, LBLNRA is managed by the USDA-Forest Service, and, as the focal point of a $600 million tourism industry, it remains one of the most visited attractions in Kentucky and Tennessee. With 300 miles of undeveloped shoreline, LBL hosts an average of two million visitors each year who come from all over the nation and more than 30 foreign countries. Land Between the Lakes National Recreation Area offers a multitude of recreational opportunities and provides unique experiences in the areas of environmental education and historic interpretation. As a part of the wildlife-viewing opportunities at LBL, bluebird nest boxes are located along bluebird trails in 19 different areas, and birders and other visitors can observe nearly all of the boxes. (Note: According to the North American Bluebird Society, a bluebird "trail" is simply a series of bluebird nest boxes placed along a prescribed route.)

Secondary Location:

Consisting of 3,700 acres, **Lake Barkley State Resort Park (LBSRP)** is the largest park in the Kentucky State Park system, and it is often called the system's flagship park. It is located on the shore of Lake Barkley in Trigg County, Kentucky, approximately ten miles east of the center of Land Between the Lakes. The park offers a wide variety of recreational pursuits for outdoor enthusiasts, including golf, fishing, boating, swimming, tennis, hiking, camping, trap shooting, and birding. As an integral part of the wildlife-viewing opportunities in the park, nearly all of the bluebird nest boxes located there can be observed from the roads or some of the rooms in the Lodge. Additionally, one of the park's nest boxes has a camera in it, and park guests can view the live activities of nesting bluebirds on a monitor located inside the Lodge.

Location of LBLNRA Bluebird Nest Boxes and Related Data

Area	Number of Nest Boxes	Bluebird Fledglings in 2019
North Information Center	5	36
Hillman Ferry Campground	7	61
Woodlands Nature Watch Area	40	244
Energy Lake Campground	7	62
Fenton Special Events Area	5	60
Elk-Bison Prairie	11	99
Golden Pond Visitor Center	16	107
USDA-FS Administration Office	5	26
Hunter's Check Station	3	15
Central Maintenance Area	7	54
Colson Overlook	1	7
Road 172-(route to former Rushing Creek Campground)	5	40
The Homeplace-1850	4	31
South Bison Range	25	163
South Maintenance Area	6	40
Brandon Spring Group Center	9	81
South Information Center	6	29
Piney Campground	10	81
Total	**172**	**1,236**

Summary of Data

Land Between the Lakes National Recreation Area (LBLNRA)

Bluebird Nesting Attempts and Eggs

During the 2019 nesting season, a total of 1,471 Eastern Bluebird (*Sialia sialis*) eggs were laid in the 172 bluebird nest boxes at the Land Between the Lakes NRA, with 1,236 bluebirds fledging, for an 84% fledging success rate. (Note: A young bird has "fledged" if it leaves the nest on its own.) Adult bluebirds made 353 nesting attempts in the boxes. (Note: An "attempt" is defined as a bird building a nest and laying at least one egg.) Compared to the previous year, this was a significant increase (23.4%) in the number of bluebird nesting attempts and a comparable increase (25%) in the number of eggs produced. A review of the long-term data shows it was the highest amount since the 2013 nesting season for both of these important factors of avian population growth. These statistics seem to indicate the LBLNRA bluebird population is continuing its gradual recovery from the devastating ice storms that occurred during the winters of 2013-2014 and 2014-2015.

In 2019, there were 185 unhatched bluebird eggs (12.6% of the egg total) and 50 dead bluebird nestlings (3.4% of the egg total) discovered in the boxes. Both of these numbers were above the average of recent years, resulting in a somewhat negative impact on the number of fledglings produced during the nesting season. After a somewhat cool, wet spring, periodic rains continued throughout much of the summer months in 2019, and the weather may have had a limiting effect on the number of successful broods. (Note: For additional information, please see the explanation regarding "gunk" under the section labeled, **Anecdotal Remarks**.)

During the 2019 nesting season, only four nest boxes at the LBLNRA had no nesting attempts by *any* species. (Comparatively, 12 nest boxes had no nesting attempts in 2018, eight nest boxes had no nesting attempts in 2017, ten nest boxes had no attempts in 2016, 27 nest boxes had zero attempts in 2015, and 33 nest boxes had no attempts in 2014. In 2013, only four nest boxes had no nesting attempts by any species. The higher rate of nest box occupancy in the past six years appears to be at least partially due to significantly more nesting attempts by *other* species. One could surmise this increase is related to the post-ice storm decrease in the LBLNRA bluebird population, which has provided opportunities for more nesting attempts by other cavity-nesting species. In 2019, the number of eggs laid by other species in the nest boxes was 121 eggs, resulting in 95 fledglings. (Please see the section labeled **Other Cavity-nesters** for an itemization of individual species.)

Specific LBLNRA Areas with Decreases/Increases in 2019

As previously mentioned in this report, bluebirds had a significant increase in the number of nesting attempts in 2019, resulting in a somewhat commensurate increase in the number of eggs laid in the nest boxes. Compared to the previous year, the fledgling numbers increased this year in nearly all of the eighteen areas of the LBLNA where bluebird nest boxes are located, with only the Colson Overlook Area experiencing a slight decrease (9 fledglings➔7 fledglings).

The most significant increases in fledglings---in terms of percentage---occurred in the following areas: North Information Center Area (23➔36 = 57%), Woodlands Nature Watch Area (199➔244 = 23%), Central Maintenance Area (31➔54 = 74%), Road 172

Area (25➔40 = 60%), South Maintenance Area (21➔40 = 90%), and Brandon Spring Group Center (57➔81 = 42%).

White Bluebird Eggs

In 2019, 34 white bluebird eggs were found in the LBLNRA nest boxes (2.3% of the egg total), resulting in 24 fledglings from those eggs. More specifically, white bluebird eggs were found in nest boxes in the following areas: Woodlands Nature Watch Area (4 eggs), Golden Pond Visitor Center Area (8 eggs), Road 172 Area (6 eggs), South Bison Range Area (12 eggs), and South Welcome Center Area (4 eggs).

[Note: Statistically, it's estimated that less than 4% of all Eastern Bluebird eggs are white, with the other eggs being the more typical light blue color produced by other members of the thrush family, including the American Robin (*Turdus migratorius*). In 30 nesting seasons, the authors of this report have inspected 44,307 bluebird eggs in nest boxes along their combined trails, and 1,343 (3%) of the eggs have been white. The exact cause of albinistic (white) bluebird eggs is unknown, but most theories point toward a genetic link that may involve the periodic expression of a recessive gene. Accordingly, there is no absolute certainty that bluebirds fledged from a clutch of white eggs will also produce white eggs when they become sexually mature. Additionally, it may be noted that bluebird hatchlings from white eggs always have *blue* feathers, except in the very rare case of a white-feathered albino. (It should also be noted there is no apparent link between white egg color and white-feathered albinism in bluebirds, and any such occurrence would be extremely unusual and purely coincidental.) Furthermore, there is usually no mixture of white eggs and blue eggs in a bluebird clutch. On the rare occasion that a white egg is found among a clutch of blue eggs, or vice versa, a second female bluebird probably "dumped" the anomalous egg at an opportune moment, or a rare female bluebird had the ability to produce both blue and white eggs. [Note: Due to excessive numbers of eggs in some clutches, a few cases of suspected egg "dumping" have been noted and recorded by the monitors (e.g., two nests in 2009---all blue eggs; one nest in 2016---seven blue eggs; one nest in 2017---nine blue eggs), but no direct observation of the birds' nesting behavior could be used to confirm the authors' suspicions. Generally speaking, a female bluebird cannot successfully incubate more than a maximum clutch size of six eggs, so oftentimes egg dumping creates a scenario where very few---or none---of the eggs will hatch.] In 30 nesting seasons and inspections of several thousand bluebird clutches, the authors of this report have observed only one clutch containing a mixture of egg colors in a nest. (Note: On June 21, 2013, Nest Box 17 in the Nature Station Area contained two bluebird nestlings, as well as two white eggs and one blue egg.) Also, it should be mentioned that some bluebird researchers have documented banded female bluebirds that laid blue eggs and white eggs in the same clutch. In these cases, it is suspected the female bluebird was capable of producing only a limited amount of biliverdin, the pigment that causes blue hues in eggs.]

[Note: For additional information about white bluebird eggs, see Peak, B. 2011 "The White Bluebird Egg Phenomenon" ***Bluebird, Journal of the North American Bluebird Society*** 33(4): 16-19.]

Runt (Dwarf) Bluebird Eggs

No runt bluebird eggs were found in the LBLNRA nest boxes during the 2019 nesting season. In 30 nesting seasons, the authors of this report have found only *seven* runt bluebird eggs in nest boxes (out of 44,307 eggs---which is approximately 0.016%, or about one out of every 6,000 eggs). Five of the runt eggs were found in nest boxes at the LBLNRA, and the other two were discovered in boxes at nearby Lake Barkley State Resort Park (LBLNRA: 1992, 2003, 2010, 2017, 2018; LBSRP: 2006, 2012).

[Note: In reference to avian eggs, the terms *runt* and *dwarf* are used interchangeably by ornithologists and oologists (egg scientists). (Sidebar: The term *runt* may also be used to describe a nestling bird that is noticeably smaller than all of the other nestlings in a brood.) In addition to being significantly smaller and weighing much less than a normal egg, runt/dwarf eggs may be more

spherical, frequently have a thick, rough shell, and lack a yolk. Consequently, runt eggs will not produce a viable young bird. Normally, Eastern Bluebird eggs are about 22 mm long and about 16 mm wide at the widest point. (Zeleny, 1983) Oological guides describe normal bluebird eggs as being oval to short-oval in shape. (Harrison, 1975) When a (normal) bluebird egg is deposited in the nest, the egg weighs about three grams (or 1/10 of an ounce), which is approximately ten percent of the weight of an adult bluebird. (Pitts, 2011)]
[Note: For additional information about runt bluebird eggs, see Peak, B. 2013 "The Runt Bluebird Egg Phenomenon" ***Bluebird, Journal of the North American Bluebird Society*** 35(3): 9-12.]

Winterkills

In 2019, there were two dead male bluebirds discovered in the nest boxes at the beginning of the nesting season, and both appeared to be winterkills. [Note: Typically, only one or two winterkilled bluebirds are found in the LBLNRA nest boxes in March, and in more than half of the 30 nesting seasons, *no* winterkills were found.] The winterkilled bluebirds were found in the following areas: Elk and Bison Prairie Area (Nest Box 10, one dead male) and The Homeplace-1850 Area (Nest Box 4, one dead male). Winterkills may occur during late winter ice storms or bitterly cold weather, when the birds' fat reserves are depleted and food supplies are scarce or covered with snow/ice. During the winter months, when temperatures fall below 25° F. and/or weather conditions are life threatening, bluebirds may roost in a nest box during the night. In some cases, many birds will congregate in a single box, thereby providing body heat for one another. (However, if conditions are particularly harsh, these emergency communal behaviors may not be sufficient, and all of the birds may perish. As a case in point, in March, 2015, after late winter ice storms, the monitors found 11 dead bluebirds in a single nest box.)
[Note: For additional information about sex and age of winterkilled bluebirds, see Peak, R. 2016 "Eastern Bluebird Winterkills: An Analysis of Sex and Age" ***Bluebird, Journal of the North American Bluebird Society*** 38(3): 14-16.]

Monitoring Protocol and Bluebird Nesting Biology

From nest construction to the fledging of the young birds, the Eastern Bluebird's reproductive cycle encompasses approximately one month. Therefore, the volunteers must follow a monthly monitoring protocol to accurately determine the outcome of each nesting attempt. [Note: A female bluebird usually builds a nest in less than a week and lays one egg per day until the clutch is complete. Eastern Bluebird clutches typically consist of three to six eggs. When the last egg (or, in some instances, the penultimate---next to last) has been laid, the female begins incubation of the eggs, which takes about 12-14 days (on average). After the eggs hatch, both bluebird parents feed the nestlings for about 16-18 days (on average). When the juveniles fledge, the bluebird parents may feed them for an additional two weeks, or until the young birds can secure food on their own. Approximately two-thirds of an eastern bluebird's diet consists of insects and other invertebrates. (During some nesting seasons, the authors have found small, dead ringneck snakes---*Diadophis punctatus*---or small, dead lizards---species unknown---in the nest material, which evidently were food offerings rejected by the bluebird nestlings.) The remainder of the bird's diet is made up of wild fruits. In Kentucky, a female bluebird will usually produce two broods during the nesting season, and a third brood is possible. (If there is unusually warm weather in the late winter/early spring, resulting in an extended nesting season, it is possible for four broods to occur in a nest box. However, that scenario would typically involve broods produced by more than one adult female bluebird in the same nest box.) Bluebirds do not reuse a nest, so the nest material may be removed as soon as the juvenile birds have fledged. Throughout the winter months, if weather

conditions and temperatures become intolerable (typically, below 25° F.), wintering bluebirds may use the nest boxes as roost sites.]

The volunteers monitored all of the LBLNRA boxes on the following dates: March 27-28, April 23-24, May 20-21, June 10-11, July 8-9, and August 6-8. To update and finalize data for specific boxes, additional monitoring was completed on July 26, August 16, August 28, and September 3. (A severe windstorm on June 21, 2019 caused considerable damage in Energy Campground, thereby necessitating a delay in monitoring the nest boxes in that area until July 26.)

During the monthly monitoring process, each nest box is inspected, and the contents are recorded on field sheets and cumulative data sheets. Anecdotal information is also recorded on the field sheets. At the conclusion of the nesting season, these sheets are used to compile statistical information and determine anecdotal accounts for each area. [Sidebar: In 30 nesting seasons---210 months of monitoring nest boxes---the volunteers have missed only two months.]

When monitoring, the volunteers use the following criteria as indicators of fledging success for bluebirds and most cavity-nesters:

(1) Nestlings have vacated the nest box and/or there are no eggs in the nest box.
(2) Nest material is somewhat compressed or flattened (due to maturation of the nestlings).
(3) There is no indication or evidence of predation by small mammals, snakes, or other birds.
(4) There is an abundance of pin feather scales in the nest, which are disintegrated remains of the keratinous sheaths that encase the nestling's flight feathers---this whitish material resembles human dandruff.
(5) There is a collection of fecal material (usually white) attached to the inside walls of the nest box---it is deposited as the mature nestlings exercise and prepare for flight.

Other Cavity-nesters

In 2019, the LBLNRA nest boxes also yielded 11 Prothonotary Warbler (*Protonotaria citrea*) fledglings (out of 29 eggs), 53 Carolina Chickadee (*Parus carolinensis*) fledglings (out of 58 eggs), 20 Tree Swallow (*Iridoprocne bicolor*) fledglings (out of 22 eggs), 7 Tufted Titmouse (*Baeolophus bicolor*) fledglings (out of 7 eggs), and four Carolina Wren (*Thryothorus ludovicianus*) fledglings (out of five eggs).

[Note: The Prothonotary Warbler is a neo-tropical migrant and is the only cavity-nesting warbler in the eastern United States. Due to loss of forested wetlands in the U.S. and decreasing mangrove habitat on its wintering grounds in Mexico, Central America, and South America, the warbler's population is declining. According to the North American Breeding Bird Survey, the warbler's populations declined over 1% per year from 1966–2015, resulting in a cumulative loss of 42% over that period. The species rates a 14 out of 20 on the Continental Concern Score and is on the North American Bird Conservation Initiative Watch List, which includes bird species that are most at risk of extinction without significant conservation actions to reverse declines and reduce threats. Installation of nest boxes with predator guards and restoration of natural flood regimes to forested wetlands on the breeding grounds have been successful at increasing local populations. (source: The Cornell Lab of Ornithology, 2015)]

As previously mentioned, the number of bluebirds fledged in 2019 seems to indicate a core bluebird population is continuing a recovery phase in the LBLNRA following the ice storms of 2014 and 2015. Fledgling totals for the past 30 years are enumerated in Table 1.

TABLE 1

Land Between the Lakes National Recreation Area

Year	Number of Nest Boxes	Bluebirds Fledged
1990	108	544
1991	153	720
1992	159	727
1993	155	820
1994	159	898
1995	157	872
1996	156	754
1997	162	599
1998	149	774
1999	152	719
2000	153	871
2001	154	964
2002	158	1,086
2003	161	978
2004	164	1,129
2005	164	976
2006	165	1,092
2007	165	1,050
2008	165	991
2009	165	1,184
2010	170	1,195
2011	170	1,399
2012	170	1,348
2013	170	1,377
2014	170	830
2015	171	759
2016	171	971
2017	171	1,045
2018	172	963
2019	172	1,236
Total 30 years	(not applicable)	**28,871**

Some biologists consider the number of bluebirds produced per nest box as the most accurate measure of bluebird trail success. If that ratio is utilized, the 2019 nesting season, with 7.2 bluebirds fledged per nest box, ranks as the best year since 2013 (8.1 per box). This data point is further evidence the LBLNRA bluebird population made considerable strides in the recovery process during the 2019 season.

During the volunteers' 30-year tenure, 1,946 additional juvenile birds---representing six species [Carolina Chickadee, Tufted Titmouse, Tree Swallow, Prothonotary Warbler, Carolina Wren, and White-breasted Nuthatch (*Sitta carolinensis*)]---have fledged from the LBLNRA bluebird nest boxes. In 1999 and 2001, a seventh species---a Great

Crested Flycatcher (*Myiarchus crinitus*)---had unsuccessful nesting attempts in a nest box at the Golden Pond Visitor's Center Area.

Anecdotal Remarks

In 2019, the monitors discovered ten dead bluebird nestlings in four separate nest boxes at the LBLNRA that appeared to have succumbed to a condition informally called "gunk".

[Note: The birds' feathers were saturated with dark, greasy material which nest box monitors sometimes describe as "gunk" (gooey junk), or "fecal glue". Apparently, due to this condition, the baby birds could not fledge (fly away from the box). Sometimes, entire clutches of bluebirds covered with "gunk" will die. According to Bet Zimmerman (***Sialis.org*** Web site), theories on the cause of "gunk" include the following:

- Severe diarrhea, resulting in an inability to form fecal sacs (encapsulated excrement). This may occur in bluebird babies fed earthworms and can result in dehydration and death. Earthworms may be used as a source of food by bluebird parents during inclement weather (esp., cold, rainy days) when nothing else is available. The baby birds' undeveloped stomachs apparently cannot handle earthworms due to the dirt castings in a worm's gut, and it's possible that chemicals in the earthworms break down the birds' fecal sacs, thereby creating the "gunk" that coats the birds' feathers. (Diarrhea can also occur if nestlings ingest excessive amounts of fruit.) As an additional complication, microscopic nematodes (roundworms) living inside the earthworms may also infect both adult and juvenile bluebirds, possibly leading to their deaths.
- The fecal build-up may occur when parents are under stress - e.g., a single parent frantically trying to feed a clutch (especially a large one) and/or spending so much time trying to find food that it cannot attend to removing fecal sacs.
- A small nest box floor size may aggravate the "gunk" problem, as the excrement is more concentrated.]

On August 7, 2019, the monitor found a single bluebird nestling with deformed legs in Nest Box 22 in the Woodlands Nature Watch Area. (Three other nestlings from the clutch had already fledged from the nest box.) Upon inspection, it was determined the bird had an enlargement of the hypotarsus (where the tibiotarsus connects with the tarsometatarsus, which is comparable to the ankle joint in humans) on both legs, which prevented it from perching or walking. Otherwise, the bird was fully feathered and looked healthy, and it appeared the bluebird parents were continuing to provide it with food. Unfortunately, when the nest box was monitored on August 28, 2019, the deceased nestling was found in the box.

While monitoring the bluebird nest boxes in 2019, the volunteers observed that some of the boxes were used at various times by tree frogs (species unknown), ants, wasps, and a variety of other insects. As previously mentioned, small ringneck snakes (*Diadophis punctatus*) and small lizards (species unknown) were found in a few bluebird nests. Apparently, the dead snakes and lizards were rejected by the bluebird nestlings because the reptiles were too large to swallow. Small snail shells (species unknown) were also found in a few nests, suggesting the snail shells were inedible, or perhaps only the soft snail body parts were fed to the nestlings. During the summer months, a few nests contained the indigestible pits of wild black cherry fruits (*Prunus serotina*). During each nesting season, a very small number of blowfly pupal cases (species unknown) are occasionally found in a few nest boxes, but the blowflies do not appear to

have a detrimental effect on the young birds. [Note: Blowflies are ectoparasites, and female blowflies may lay 50-200 eggs in a bird's grass nest, usually when avian nestlings are first hatched. More than one blowfly may lay eggs in the nest, and the female blowfly dies after laying its eggs. In one or two days, the eggs hatch into tiny, tan-colored larvae that grow to 3/8" long. The larvae may attach to a nestling's feet, legs, or the underside of wings and beaks, and draw out blood and body fluids. Blowflies primarily attack the nestlings at night and hide in the nesting material during the daylight hours. In some parts of the country, researchers have found as many as 250 blowfly larvae in a bird nest. The larvae feed on the nestlings for approximately eight days and then go into a dormant stage for three days, becoming leathery pupae. After 10-12 days, the adult blowflies emerge from the puparia and fly away in search of fresh bird nests, where they will repeat the 3-week life cycle. Typically, blowflies do not kill avian nestlings, unless other stress factors, such as prolonged rainy weather, drought, or food shortages, occur at the same time.]

Maintenance work on the nest boxes/posts was completed on additional days in February, March, September, and October. The two volunteers spent over 350 hours working on Project SOS, which included preparatory work, travel time to LBL, nest box monitoring work in the field, maintenance work in the field, data compilation and reporting, and giving presentations to groups.
[Throughout the year, the volunteers present bluebird programs and presentations for various organizations. For many years, the volunteers have given these presentations in Kentucky and other states, thereby promoting eco-tourism in Kentucky and serving as advocates and ambassadors for the LBLNRA and the Kentucky Department of Parks.]
The volunteers drove approximately 1,200 miles at LBLNRA to monitor, repair, or relocate bluebird nest boxes. (Note: The volunteers would like to thank the USDA-Forest Service for providing a vehicle for the fieldwork at the LBLNRA.)

On April 25-27, 2017, the volunteers used a Garmin handheld device to record the Global Positioning System coordinates for each bluebird nest box at Land Between the Lakes National Recreation Area. The information is stored in a USDA-Forest Service database. This will permit future nest box monitors and avian researchers to easily locate each box for continued studies of the Eastern Bluebird population at the National Recreation Area. In the future, the new GPS locations for any relocated (or new) nest boxes will be recorded and added to the database.

Lake Barkley State Resort Park

Bluebird Nesting Attempts and Eggs

As an additional part of Project SOS, the volunteers used their own vehicle to check and maintain a bluebird trail (60 nest boxes) they established at nearby Lake Barkley State Resort Park (LBSRP) in 1990. In 2019, there were 449 bluebird eggs laid in the LBSRP boxes, with 378 birds fledging, for an 84.2% fledging success rate. There were 105 nesting attempts by bluebirds at the state park, which was an 18% increase compared to the previous year. The ratio of bluebirds fledged per nest box was 6.3. The volunteers also found 49 unhatched bluebird eggs (10.9% of the egg total), and 22 dead bluebird nestlings (4.9% of the egg total) in the park's boxes. Nest Boxes 2 and 4 in the Maintenance Area, Nest Box 12 on Water Tower Road, and Nest Box 1 in the Marina Area had no nesting attempts by *any* species.

Monitoring Protocol
The volunteers monitored all of the LBSRP nest boxes on the following dates: March 26, April 26, May 22, June 16, July 10, and August 8. To update data for specific boxes, additional monitoring was done for those boxes on August 28. Maintenance work on the nest boxes/posts in the park was completed on additional days in March, April, June, and September.

The total bluebird fledglings at LBSRP for previous years are noted in Table 2.

TABLE 2

Lake Barkley State Resort Park

Year	Number of Nest Boxes	Bluebirds Fledged
1990	10	23
1991	10	27
1992	27	91
1993	30	103
1994	31	85
1995	29	87
1996	29	67
1997	28	99
1998	28	93
1999	29	118
2000	29	128
2001	36	116
2002	37	148
2003	37	302
2004	41	296
2005	41	316
2006	41	350
2007	50	405
2008	53	405
2009	56	511
2010	60	472
2011	60	506
2012	60	538
2013	60	437
2014	59	330
2015	60	270
2016	60	367
2017	60	351
2018	60	326
2019	60	378
Total: 30 years	(not applicable)	**7,745**

Winterkills
In 2019, the volunteers did not find any winterkilled bluebirds at the state park when the nest boxes were monitored on March 26. [Note: In the majority of the nesting seasons from 1990 to 2013, no winterkilled bluebirds were found in the LBSRP nest boxes, and in a handful of years, only one winterkilled bluebird was discovered at the beginning of a nesting season.] After late-winter ice storms in 2014 and 2015, an unprecedented total of 48 winterkilled bluebirds were found in the state park nest boxes. Since the 2014-15 ice storms, the subsequent dramatic decrease in the breeding bluebird population has resulted in a slow recovery in the park, and it may take several more years for the bluebird fledgling numbers to return to the high level of 2012 (538 fledglings).

White Bluebird Eggs
During the 2019 nesting season, no white bluebird eggs laid in the park's nest boxes. It's the first time since 2011 that no white eggs were discovered in those boxes.

Other Cavity-nesters
In 2019, there were also 17 Carolina Chickadee fledglings (out of 17 eggs), ten Tufted Titmouse fledglings (out of ten eggs), and nine Prothonotary Warbler fledglings (out of nine eggs).
There were eight nesting attempts by House Sparrows (*Passer domesticus;* alpha code HOSP) in the LBSRP Lodge boxes (Nos. 4, 5, 6, 7, 9,10), but none were permitted to be successful. [Note: House Sparrows are nonnative birds that are ***not*** protected by any state or federal laws. When competing for nest sites, House Sparrows may kill adult bluebirds and destroy their eggs/babies. As examples of that point, on April 26, a dead adult bluebird (sex unknown) was discovered in Nest Box 4, and on June 16, a dead adult male bluebird was discovered in Nest Box 4. In both cases, the boxes had House Sparrow nests in them, and the bluebirds' bodies were partially woven into the HOSP nest material.]
When compared to the previous year, the House Sparrow domination of these Lodge nest boxes resulted in another decrease in the bluebird fledgling total for the area. In 2018, the bluebird fledgling total had dropped 27% compared to the 2017 total. As a result of these House Sparrow interferences in the Lodge Area, the affected nest boxes will be relocated to more productive areas in the park for the 2020 nesting season.
Since 1990, in addition to bluebirds, the LBSRP bluebird trail has yielded a total of 539 fledglings that were produced by five species (Carolina Chickadee, Tufted Titmouse, Prothonotary Warbler, Carolina Wren, and Tree Swallow).

Anecdotal Remarks
In the spring, 2019, periods of rainy weather in March, April, and May seemed to have a stifling effect on bluebird nesting attempts and egg production. During the remainder of the nesting season, the number of second and third nesting attempts by bluebirds at the state park seemed to be below average, and overall clutch size also seemed to be somewhat less than average. Nevertheless, when compared to the previous year, the number of nesting attempts in the park's nest boxes increased by 18%, putting it at a level comparable to 2016 and 2017.

Prothonotary Warblers at John James Audubon State Park (JJASP)

In 2010, in an effort to address the plight of Prothonotary Warblers (alpha code: PROW) previously mentioned in this report, the volunteers decided to establish a trail of PROW nest boxes around the periphery of Recreation Lake at John James Audubon State Park (Henderson, Kentucky). Twelve wooden nest boxes---designed for prothonotary warblers---were placed in strategic locations at the water's edge on March 15, 2010. In recent years, some of the boxes had become dilapidated, so the volunteers repaired them and replaced several damaged support poles prior to the 2019 nesting season.

During the 2019 nesting season, Charlie Crawford, a Henderson County resident and avid birder, volunteered to monitor the PROW nest boxes from March to the end of July, and he recorded 18 Prothonotary Warbler fledglings and 6 Carolina Chickadee fledglings. (A Carolina Wren laid four eggs in one of the boxes, but the nesting attempt was unsuccessful.) This is the highest number of PROW fledglings ever recorded for the nest boxes at JJASP, and since there is some evidence that Prothonotary Warblers may exhibit some degree of nest site fidelity, the volunteers are hopeful surviving birds will return to the park in 2020.

Conclusion

In summary, during the 2019 nesting season, the total number of Eastern Bluebird fledglings for Project SOS (LBLNRA and LBSRP combined) was 1,614. There were also 70 Carolina Chickadees, 20 Tree Swallows, 17 Tufted Titmice, 20 Prothonotary Warblers, and four Carolina Wrens that fledged from the combined nest boxes. Since the project was started in 1990, there have been 36,616 bluebird fledglings, as well as 2,599 fledglings produced by seven other cavity-nesting bird species.

[Note: Due to the following factors, the fledgling totals listed in this report are conservative figures and probably do not reflect the *actual* number: (1) If any evidence exists that fledging may *not* have occurred, the volunteers count the entire clutch/brood as a nesting failure. (2) Occasionally, female bluebirds may lay additional eggs immediately after nest box inspections have been recorded for a given month, and the "extra" juvenile birds may fledge before the volunteers complete the next monthly inspection. Therefore, given these two factors, the exact number of fledglings may be slightly <u>greater</u> than the totals in this report.]

As always, the goal of Project SOS is to maintain a core population of bluebirds to counterbalance severe seasonal conditions, particularly winter conditions comparable to the winters of 1977 and 1978, which proved to be devastating for bluebirds and many other songbirds. The Winters of 2013-14 and 2014-15---and the nesting seasons following them---demonstrate that a core population of bluebirds does seem to exist in the areas monitored by the volunteers, and hopefully the western Kentucky/Tennessee population in these areas will experience a rebound effect in a much shorter time frame than it did before bluebird trails were established in the mid-1980's.

As an added endorsement of the project, the eastern bluebird has been selected by the USDA-Forest Service as a management indicator species for LBL. Management indicator species are animal (or plant) species selected for use as a planning tool in accordance with the regulations of the National Forest Management Act (1982). These indicator species are used to help set management objectives, analyze effects of alternatives, and monitor plan implementation. The eastern bluebird has been chosen because its population changes are believed to indicate the effects of management on selected biological components (i.e. snags in open forest situations and non-game species of interest).

The bluebird trails monitored by the volunteers at LBL and the state parks cover a four-county area (Trigg County, KY, Lyon County, KY, Henderson County, KY, and Stewart County, TN). The nesting data in this report will be shared with the USDA-Forest Service, the Kentucky Department of Parks, Lake Barkley State Resort Park, Friends of Land Between the Lakes, the North American Bluebird Society, and other governmental or ornithological organizations.

Since birding is one of the most prevalent recreational activities in the United States, and eco-tourism has become a driving force in the recreational pursuits of millions of Americans, the economic benefits of Project SOS are immeasurable. For that reason, in future years, the project should continue to be a valuable enhancement for Land Between the Lakes National Recreation Area and Lake Barkley State Resort Park.

(Questions or comments about this report may be directed to Bob and Judy Peak at: **mtman1@yahoo.com**.)

Cover photograph by the North American Bluebird Society
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