EASTERN BLUEBIRD PRODUCTION IN NESTING BOXES IN PINE PLANTATIONS

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Abstract: Seventy-four nest attempts by the eastern bluebird *(Sialia sialis)* were made from 1977 - 80 in nesting boxes in 2 loblolly pine *(Pinus taeda)* plantations, age 1 - 4 years in east-central Mississippi. Of the 303 bluebird eggs laid, 245 (81%) hatched and 232 (77%) produced fledglings. Mean number of young fledged per successful nest averaged 3.87, with an average clutch size of 4.42. The largest number of nest attempts, eggs laid, and number fledged occurred at plantation age 3 years. The 1st nest attempts began in March and the latest were in August, with most young fledging in May, June, and July.

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Eastern bluebird *(Sialia Sialis)* numbers may have declined as much as 90% in the last 40 years. The decline was brought about by several factors, but the main reason was a shortage of nesting cavities (Zeleny 1977). Bluebirds nest only in cavities, and the number of cavities available for bluebird reproduction has decreased because of land use changes and competition from house sparrows *(Passer domesticus)* and starlings *(Sturnus vulgaris)* (Zeleny 1976).

Demand for southern forest products and subsequent changes in forest management practices have compounded the problem. Pine (*Pinus* spp.) production can be greatly increased through intensive pine plantation management. Typically in plantation establishment, the mature forest, which contains natural cavities for nesting is clear-cut after which the tract is mechanically site prepared (chopped, bedded, or tree-crushed) and pine seedlings are planted (Warren 1980). Even-aged timber management and extensive removal of dead trees are detrimental to bluebirds (Pinkowski 1976).

Bluebird populations can be increased by providing nesting boxes (Zeleny 1977). The purpose of this study was to determine if bluebirds and other cavity nesters would successfully use nesting boxes in young pine plantations.

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METHODS

Two loblolly pine *(Pinus taeda)* plantations, 65 ha in size and located about 4.8 km apart, near Longview (Oktibbeha County), Mississippi, in the Interior Flatwoods land resource area in the Upper Coastal Plain were studied (Pettry 1977). Fifty-year-old pine-hardwood forests occupied the sites until the summer of 1976 at which time the forests were clear-cut. Residual plant material was sheared, raked into windrows, and burned (Hurst and Warren 1980). After the areas were bedded, 1-year-old loblolly pine seedlings were hand-planted at a spacing of 2.1 × 2.4 m

(315/ha) in March 1977. No silviculture practice was applied to the plantations after planting.

Pine-hardwood forests surrounded both study areas with a few small hay fields and pastures in the general vicinity. In the fall of 1979 an 89-ha tract located south of study area 1 was logged, but not site prepared. A 97-ha tract located north of study area 2 was logged in the summer of 1979, site prepared (bedded) in 1980, and planted 1981.

Wooden nesting boxes with 4 different outside dimensions, 10.2 × 10.2 × 20.3 cm, 10.2 × 10.2 × 25.4 cm, 12.7 × 12.7 × 20.3 cm, and 15.2 × 15.2 × 38.1 cm (front width × side width × height), were placed on the study areas in March 1977. Entrance holes of the boxes were 3.2, 3.8, or 5.1 cm. Preferred entrance hole size for bluebirds is 3.8 cm, with a 3.2 cm hole being too small. Boxes with 3.2 cm holes were placed on the areas to provide nesting places for Carolina chickadees *(Parus corolinensis)* and other small, cavity nesting species (Zeleny 1976). Each study area had a total of 45 boxes in 1977 and 1978, with about equal numbers of boxes with entrance holes of 3.2 and 3.8 cm. Included in the total number of nesting boxes were 5 of the largest boxes which had 5.1 cm entrance holes and 5 plastic milk jugs (0.264 L) which had 3.8 cm entrance holes. The jugs were painted black and then white (Stewart 1976). The wooden nesting boxes were not painted and were attached to 2.13 m long creosoted posts, which were driven about 0.61 m into the ground.

In March 1979 some of the older boxes, mostly those with holes 3.2 cm, were taken down and new bluebird nesting boxes with 3.8 cm entrance holes were placed on the areas. Area 1 had 38 (1979) and 31 (1980) nest boxes and area 2 had a total of 31 (1979) and 22 (1980). No plastic jugs were on the areas in 1979 or 1980.

Nesting boxes were placed in 5 rows, which were about 55 m apart in 1977 and 1978. Boxes within the rows were about 55 m apart. In 1979, the boxes were moved wider apart within and between rows (91.4 m) and there were 6 rows, including about 40.5 ha.

Nesting boxes were examined from late March to early September. The boxes, which opened at the front or top, were inspected every 2 weeks (1977), 9 - 10 days (1978), and once a week in 1979 and 1980. To discourage predators, liquid creosote was poured on posts and on the ground around posts that had active nests in 1977 and 1978. Conical (metal) predator guards, radius of 76.2 cm, were placed on posts that had active nests in 1979 (Burtt 1979). Wasps *(Polistes annularis)* and their nests in nesting boxes were sprayed with Wasp-Stopper® (Perchloroethylene). An area about 3.1 m in diameter around each post was cleared of brush (1977 - 79).

RESULTS

Seventy-four bluebird nesting attempts (at least 1 egg laid) were made on the 2 areas from 1977 - 80. Seventy-seven percent of the attempts were successful (at least 1 bluebird fledged) on area 1 and 85% were successful on area 2. More nest attempts (29) were made in 1979 than any other year. Nest success was 100% on area 2 in 1977 and 1978, but declined to 33% in 1980 at plantation age 4 years (Table 1).

Table 1. Bluebird nesting attempts in nesting boxes in 2 pine plantations (age 1 - 4 years), Longview, Mississippi, 1977 - 80.

	Nest Attempts[a]				Eggs					
	Suc.		Unsuc.		Laid		Hatched		Number Fledged	
Year	1	2	1	2	1	2	1	2	1	2
1977	6	7	3	0	33	29	22	28	22	28
1978	5	9	0	0	23	38	23	36	23	36
1979	7	15	5	2	45	72	34	61	27	57
1980	9	2	0	4	41	22	33	8	31	8
Total	27	33	8	6	142	161	112	133	103	129

[a] Suc. = Successful means at least 1 bluebird was fledged; Unsuc. = Unsuccessful means a nest was built and at least 1 egg was laid, but not fledglings were produced; 1 = pine plantation 1; 2 = pine plantation 2.

During the 4 reproductive seasons 303 bluebird eggs were laid on the 2 areas, of which 245 (81%) hatched. The largest number of nest attempts, eggs laid, and eggs hatched occurred in 1979, particularly on area 2 at plantation age 3 years. Mean clutch size for successful nests was 4.42 eggs (range = 3-5). Three clutches had 3 eggs, 31 clutches contained 4 eggs, and 26 clutches had 5 eggs. Over the 4-year period 95% of the eggs that hatched (245) resulted in a bluebird fledgling (232). Mean number of young fledged per successful nest was 3.82 on area 1 (mean range 3.7 - 4.6) and 3.91 on area 2 (mean range 3.6 - 4.0). Seventy-two percent (area 1) and 80% (area 2) of the eggs laid yielded bluebird fledglings. The number fledged increased only slightly each year on area 1. On area 2 the number fledged increased from 28 in 1977 to 57 in 1979, then declined to only 8 in 1980. The low production in 1978 was due in part to 3 nest abandonments with a total of 13 eggs in May - June. The cause(s) of abandonment was not known for 2 nests and the presence of fire ants *(Solenopsis saevissima)* on the eggs was the probable cause of abandonment in 1 case.

Nest building began in late March with the 1st eggs being laid in early April. The 1st fledging took place in early May and the last in late August. The bluebird is a multi-brooded species and 3 periods of nesting activity were observed, March - April, May - June, and July - August. Adult bluebirds were not marked, but from an inspection of chronological data, the number of active pairs of bluebirds on the areas (combined) varied from 1 - 7. The greatest number of active pairs and the highest rate of productivity (number fledged per pair) occurred in the May - June nesting period (Table 2). The number of bluebirds fledged by month was 73 (May), 64 (June), 59 (July), and 36 (August).

Based on chronological data and use of the same nesting box, the highest number of multiple nesting attempts, apparently by the same pair of bluebirds, was 5 (area 2 in 1979). In 1978 only 4 nesting boxes on area 2 were used, but 3 of these boxes were each used 2 times and 1 was used 3 times. Broods of 5, 4, and then 3 bluebirds were fledged from this latter box. Time between successive nesting attempts varied from 14 - 24 days.

Table 2. Number of active bluebird pairs and productivity (number fledged/pair), for the 3 periods of nesting activity, 1977 - 80.

	Area 1			Area 2		
	Periods of nesting activities[a]			Periods of nesting activities		
Year	1	2	3	1	2	3
1977	1 (4.0)	6 (3.0)	2 (0.0)	0 (0.0)	4 (4.0)	3 (4.0)
1978	1 (5.0)	2 (4.5)	2 (4.5)	3 (4.0)	4 (4.2)	2 (3.5)
1979	5 (2.8)	6 (1.8)	1 (2.0)	4 (4.5)	7 (3.0)	6 (3.0)
1980	4 (4.0)	3 (4.3)	2 (1.0)	3 (1.3)	2 (2.0)	1 (0.0)

[a] 1 = nesting attempts begun in March - April; 2 = May - June; 3 = July - August.

Bluebirds used nesting boxes with 3.8- and 5.1-cm entrance holes, and plastic jugs (3.8 cm) in 1978 and 1979. Most nests were constructed of pine needles. Highest use rate of nesting boxes with a 3.8-cm entrance hole was 37% on area 2 in the May - June 1979 period. Seven pairs of bluebirds were using the 40.5-ha area.

Losses of bluebird eggs or nestlings were attributed in 1 case each to raccoon *(Procyon lotor)*, a snake, fire ants, and the little black ant *(Monomorium minimum)*. Abandonment of incomplete and complete clutches occurred.

Carolina chickadees began using nesting boxes in March 1979. Six chickadees were fledged from a box on area 1 and an unsuccessful nesting attempt occurred on area 2. In 1980 2 nesting attempts occurred on area 1, with 1 box yielding 5 chickadee fledglings and the other being unsuccessful. Area 2 had 3 chickadee nest attmpets with a total of 16 eggs being laid and 8 young were fledged. One Carolina wren *(Thryothorus ludovicianus)* nest occurred in a box in 1979 and 2 young were fledged.

DISCUSSION

Preferred bluebird habitat is open and grassy, such as pastures or large lawns and not areas with heavy underbrush or tall grass and weeds (Stoddard 1978, Zeleny 1978). Intensive site preparation (bedding) produced very open, sparsely covered ground, for a short time, and the addition of nesting boxes made the young pine plantations attractive to bluebirds (Hurst et al. 1979). Bluebird production (number fledged per successful nest) averaged 3.96, which is comparable to that (3.73) reported in a southeastern Michigan study (Pinkowski 1979).

Bluebird production remained about the same on area 1 (over the 4-year period) despite a great change in plant coverage and density (Warren 1980). Production increased greatly on area 2 at plantation age 3 years then declined sharply at age 4. The low production appeared to be because of the abandonment of several clutches. The cause(s) of abandonment remain unknown.

Pine plantations in this area have very dense ground vegetation, grasses, forbs, vines [particularly blackberry (*Rubus* spp.)], hardwood brush, and pine saplings. Pine saplings averaged 4.78 m high at the end of the 4th growing season with canopy closure expected at age 6 years. However, bluebirds continued to use the nesting boxes. Conner and Adkisson (1974) found that bluebirds nested in natural

cavities in snags on small clearcuts in southwestern Virginia up to age 12 years. At this age the clearcut was densely stocked with 4 - 5-m oak (*Quercus* spp.) and hickory (*Carya* spp.) saplings. In loblolly pine plantations in Kemper County, Mississippi, Warren (1980) and Darden (1980) found that the number of bluebirds observed (seen or heard) in the spring season peaked at 41/40.5 ha at plantation age 3 years, declined to 22 at age 4 and was only 5/40.5 ha at age 8 years. These areas had been site prepared by mist-blowing and tree injection, which created many snags and natural cavities and a very dense vegetative community. Most of the snags fall to the ground by plantation age 7 years.

There are advantages of placing nesting boxes on pine plantations, other than the fact that there are millions of available hectares and that forest industry might assist in bluebird projects. First, nest cavity competitors, house sparrows and starlings, seldom use forested areas. Secondly, nest box vandalism is a minor problem in remote and seldom visited pine plantations.

The main problem with nesting boxes in plantations is predation (Tomlinson and Haines 1978, Hurst 1980*a*, 1980*b*). Predation could be kept to a minimum by putting the nesting boxes on small diameter (19 mm) electrical conduit pipes, which discourage climbing by snakes and mammals (Layton 1980). Predation by fire ants and the little black ant could be prevented by placing a band of Stikem® (Polymerized 1-Butene) on the metal pipe. Ants usually will not attempt to cross the very sticky material and will become entrapped if they touch it. The material is long lasting (3 - 4 months) and is easy to apply.

As nongame wildlife management gains acceptance and financial support, state wildlife and fish agencies will be able to expend effort on bluebird and other nongame species restoration programs. Cooperative projects involving state game and fish agencies, local, state, and national organizations, such as The North American Bluebird Society, can promote bluebird restoration. Bluebird management through nesting boxes, roosting boxes, planting fruit producing shrubs, and research should be conducted on wildlife management areas and other public and/or private lands.

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