2011

Artificial Nest Cavity Used Successfully by Native Species and Avoided by European Starlings

Laura A. Tyson
USDA/APHIS/WS, National Wildlife Research Center, laura.a.tyson@aphis.usda.gov

Bradley F. Blackwelll
USDA/APHIS/WS National Widlife Research Center, bradley.f.blackwell@aphis.usda.gov

Thomas W. Seamans
USDA/APHIS/WS National Wildlife Research Center, thomas.w.seamans@aphis.usda.gov

The Wilson Journal of Ornithology 123(4):827–830, 2011

Artificial Nest Cavity Used Successfully by Native Species and Avoided by European Starlings

Laura A. Tyson,[1,2] Bradley F. Blackwell,[1] and Thomas W. Seamans[1]

ABSTRACT.—We describe a weather-durable cavity design used successfully by cavity-nesting species native to the eastern USA and, although accessible, avoided by European Starlings (*Sturnus vulgaris*). The artificial nest cavity was constructed using 9.5-cm inside diameter polyvinyl chloride tubes cut to 27.5-cm lengths. The tubes were mounted horizontally with 5.1-cm entry holes drilled through one of the capped ends. Eastern Bluebirds (*Sialia sialis*), House Wrens (*Troglodytes aedon*), and Tree Swallows (*Tachycineta bicolor*) nested in 49 of 100, newly mounted tubes on utility poles in north-central Ohio, USA from April through June 2009. These species nested in 85% of the tubes during the same period in 2010 and fledged young from 94.1% of nests. We added 10 nest tubes (27.5-cm long × 17-cm inside diam) at sites similar to the smaller tubes in 2010. Two of the larger tubes were used by nesting starlings and six by native species. Cavity vertical depth has been shown to be an important feature in starling nest site selection, but our data from the larger tubes indicate that other factors are likely important. The smaller design could offer nesting opportunities for a range of native cavity-nesting species while limiting use by starlings. *Received 3 January 2011. Accepted 20 May 2011.*

[1] U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center, Ohio Field Station, 6100 Columbus Avenue, Sandusky, OH 44870, USA.

[2] Corresponding author; e-mail: laura.a.tyson@aphis.usda.gov

Providing artificial nest cavities to increase abundance of secondary cavity-nesting species is viewed as an effective tool (Hamerstrom et al. 1973, Newton 1994, Smith et al. 2005, Catry et al. 2009), although questions remain as to effects on avian community structure (Van Balen et al. 1982, Purcell et al. 1997, Miller 2002, Mänd et al. 2005). A variety of studies (Kalmbach and Gabrielson 1921, Brush 1983, Kerpez and Smith 1990, Cabe 1993) have concluded nest competition exists between native cavity-nesting species and European Starlings (*Sturnus vulgaris*; hereafter starling), but the resulting effects on populations are unclear (Koenig 2003).

Use of artificial nest cavities by secondary cavity-nesting birds can have conservation implications, and placement of nest structures is both popular and educational from the public perspective (Cornell Laboratory of Ornithology, Ithaca, NY, USA; http://www.allaboutbirds.org/NetCommunity/Page.aspx?pid=1139). Thus, artificial cavity designs should consider not only requirements of the target species (Gehlbach 1994), but also should minimize competitive interactions between native and invasive cavity nesters.

Our original experiment was designed to investigate a potential starling cavity repellent. We discovered avoidance by starlings of our artificial cavities prior to implementing treatments

FIG. 1. PVC nest tube mounted to utility pole with Tree Swallow present, NASA Plum Brook Station, Sandusky, Ohio, USA.

and changed our focus to report on successful use of a novel cavity design by native species across cavity size. Thus, we report only descriptive statistics with regard to species and nesting data.

METHODS

We conducted our study on the 2,200-ha National Aeronautic and Space Administration (NASA) Plum Brook Station (PB), Erie County, Ohio, USA. Habitat within PB differs from the surrounding mix of agricultural and suburban area, and is composed of dogwood (*Cornus* spp.; ~39%), old field and grasslands (~31%), open woodlands (~15%), and mixed hardwood forests (~11%) interspersed with abandoned and actively used structures, and paved roads that circle and bisect the station. Plum Brook Station has restricted public access.

We attached 100, 27.5-cm long × 9.5-cm diameter polyvinyl chloride (PVC) tubes horizontally to utility poles (using pipe straps) (Fig. 1) prior to the 2009 breeding season, maintaining 240 m between each tube. Utility poles on PB are in grass margins (20 to 30 m wide) along roadways and bordering wooded areas. We positioned the tubes facing the roadway to facilitate observations during the experiment, as opposed to maintaining an easterly or southeasterly frontage. Previous experiments with nest boxes on PB reported no effects of entrance direction on starling nesting (Dolbeer et al. 1988, Belant et al. 1998, Seamans et al. 2001, White and Blackwell 2003).

Each tube was placed 3 m above the ground with an aluminum predator guard mounted below the tube. The ends of each tube were sealed with a PVC cap, and the 5.1-cm diameter entrance, drilled into one end, was covered with tape until 27 April 2009. We checked each tube weekly after opening the tubes: date, presence of nest material, total number and species of eggs present, and number and species of young were recorded at the time of each check. We followed our nest-check protocol through nest completion (presence of young). We did not follow these nests through fledging and data collection ended on 3 August 2009.

We further investigated whether starlings used these newly designed tubes in 2010, assuming any novelty associated with the first year was no

TABLE 1. Species use of 100 27.5-cm length × 9.5-cm inside diameter, polyvinyl chloride (PVC) nest tubes attached horizontally to utility poles at 3 m in height, on the National Aeronautics and Space Administration's Plum Brook facility in Erie County, Ohio, USA. Each tube had a 5.1-cm diameter entrance. Nesting data were collected from 4 May through 12 August, 2009 and from 21 April through 8 September 2010.

Species	Year	No. nests	No. clutches depredated	No. nests failing[a]	% Nests fledging young[b]
Eastern Bluebird	2009	15	0	0	Unknown
	2010	24	1	0	96
European Starling	2009	0			
	2010	0			
House Sparrow	2009	0			
	2010	2	0	0	100
House Wren	2009	21	0	0	Unknown
	2010	18	2	1	83
Tree Swallow	2009	12	0	0	Unknown
	2010	43	1	0	98

[a] Nestlings discovered dead in nest, but no evidence of predation.
[b] Nests were not monitored through fledging in 2009.

longer a factor. We removed nest material from the previous year and closed the tubes until 14 April. We added 10 PVC tubes (27.5-cm long × 17 cm) with a 5.1-cm diameter entrance to investigate the effect of nest tube inside diameter on use by starlings and native species. These larger tubes were attached to utility poles in the same manner as the smaller tubes, and were positioned at 240-m intervals. We opened these larger tubes on 15 June. Our nest-check protocol followed that described for the 2009 breeding season for all sites with the addition of following each nest through fledging. We ended our 2010 data collection on 8 September.

RESULTS

Fifty of the smaller tubes were used for nesting in 2009, 49 by Eastern Bluebirds (*Sialia sialis*), Tree Swallows (*Tachycineta bicolor*), or House Wrens (*Troglodytes aedon*) with one nest unidentified to species (Table 1). Eighty-seven of the smaller tubes were used in 2010 with only two being occupied by a non-native cavity-nesting species. These tubes were occupied by House Sparrows (*Passer domesticus*) in close proximity to sites where bird seed was provided by an adjacent land owner. Ninety-four percent of the smaller tubes with native species fledged young (Table 1). Starlings were observed sitting on and entering the small tubes in 2009 and 2010, but no evidence of starling nesting was found in either year.

Starlings nested in two of our larger tubes (25% of occupied tubes) while six of the remaining eight tubes contained nests of Eastern Bluebirds (n = 1 positive identification by egg; 3 possible) and Tree Swallows (n = 2 nests).

DISCUSSION

Our nesting data over two breeding seasons demonstrate successful use of a PVC tube cavity by three native passerine species and avoidance by European Starlings, likely due to a reduced vertical depth. Starlings are recognized as adaptable to a range of cavity dimensions in human structures (Savard and Falls 1981, Feare 1984), but cavity vertical depth may serve as a selective factor in accessible cavities when a variety of cavity dimensions are available. For example, Mazgajski (2003) found that starlings selected nest boxes with a 22-cm vertical depth over similar boxes adjusted to achieve shallower vertical depths, possibly because of benefits in limiting predation. The smaller PVC tubes used in 2009 and 2010 replaced wood nest boxes (28-cm inside length × 12-cm width × 13- to 16-cm vertical distance from floor to sloped ceiling with 5.1-cm entrance) previously used in successive experiments with nesting starlings (Dolbeer et al. 1988, Belant et al. 1998, Seamans et al. 2001, White and Blackwell 2003). Starling use of the wood nest boxes in these studies ranged from 58 to 97% occupancy. McGilvrey and Uhler (1971) reported reduced starling use of 61-cm long × 30.5-cm diameter cylinder Wood Duck (*Aix sponsa*) tubes mounted horizontally, particularly when the openings exceeded 7.6 cm × 10.2 cm. We speculate that light penetration, lack of clear head space after nest construction or perceived or realized predation risk contributed to the reduced use of the horizontal tubes. We also found that only 20% of our horizontally-mounted larger tubes (offering >17 cm vertical depth) were used by starlings, whereas native species occupied 60% of these larger tubes.

A variety of factors can influence starling nest cavity selection (McGilvrey and Uhler 1971, Van Balen et al. 1982), and we suggest the 9.5-cm vertical depth of our smaller tubes was a limiting factor for starling use in our study. We believe the smaller tubes could meet the requirements of other native, secondary cavity-nesting passerines and the effects of vertical cavity depth on cavity use by starlings should be further investigated.

ACKNOWLEDGMENTS

Our study was funded by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center. We thank M. E. Conger and D. E. Steyer for field assistance, and E. J. Poggiali for logistical assistance. P. M. Schmidt, T .L. DeVault, J. T. Tyson, and B. E. Washburn provided reviews of earlier versions of this manuscript.

LITERATURE CITED

BELANT, J. L., P. P. WORONECKI, R. A. DOLBEER, AND T. W. SEAMANS. 1998. Ineffectiveness of five commercial deterrents for nesting starlings. Wildlife Society Bulletin 26:264–268.

BRUSH, T. 1983. Cavity use by secondary cavity-nesting birds and response to manipulations. Condor 85:461–466.

CABE, P. R. 1993. European Starling (*Sturnus vulgaris*). The birds of North America. Number 48.

CATRY, I., R. ALCAZAR, A. M. A. FRANCO, AND W. J. SUTHERLAND. 2009. Identifying the effectiveness and constraints of conservation interventions: a case study of the endangered Lesser Kestrel. Biological Conservation 142:2782–2791.

DOLBEER, R. A., M. A. LINK, AND P. P. WORONECKI. 1988. Naphthalene shows no repellency for starlings. Wildlife Society Bulletin 16:62–64.

FEARE, C. 1984. The starling. Oxford University Press, Oxford, United Kingdom and New York, USA.

GEHLBACH, F. R. 1994. Nest-box versus natural-cavity nests of the Eastern Screech-Owl: an exploratory study. Journal of Raptor Research 28:154–157.

HAMERSTROM, F., F. N. HAMERSTROM, AND J. HART. 1973. Nest boxes: an effective management tool for kestrels. Journal of Wildlife Management 37:400–403.

KALMBACH, E. R. AND I. N. GABRIELSON. 1921. Economic value of the starling in the United States. Bulletin Number 868. U.S. Department of Agriculture, Washington, D.C., USA.

KERPEZ, T. A. AND N. S. SMITH. 1990. Competition between European Starlings and native woodpeckers for nest cavities in saguaros. Auk 107:367–375.

KOENIG, W. D. 2003. European Starlings and their effect on native cavity-nesting birds. Conservation Biology 17:1134–1140.

MÄND, R., V. TILGAR, A. LÕHMUS, AND A. LEIVITS. 2005. Providing nest boxes for hole-nesting birds–Does it matter? Biodiversity and Conservation 14:1823–1840.

MAZGAJSKI, T. D. 2003. Nest site choice in relation to the presence of old nests and cavity depth in the starling *Sturnus vulgaris*. Ethology, Ecology and Evolution 15:273–281.

MCGILVREY, F. B. AND F. M. UHLER. 1971. A starling-deterrent Wood Duck nest box. Journal of Wildlife Management 35:793–797.

MILLER, K. E. 2002. Nesting success of the Great Crested Flycatcher in nest boxes and in tree cavities: are nest boxes safer from nest predation? Wilson Bulletin 114:179–185.

NEWTON, I. 1994. The role of nest sites in limiting the numbers of hole-nesting birds: a review. Biological Conservation 70:265–276.

PURCELL, K. L., J. VERNER, AND L. W. ORING. 1997. A comparison of the breeding ecology of birds nesting in boxes and tree cavities. Auk 114:646–656.

SAVARD, J.-P. AND J. B. FALLS. 1981. Influence of habitat structure on the nesting height of birds in urban areas. Canadian Journal of Zoology 59:924–932.

SEAMANS, T. W., C. D. LOVELL, R. A. DOLBEER, AND J. D. CEPEK. 2001. Evaluation of mirrors to deter nesting starlings. Wildlife Society Bulletin 29:1061–1066.

SMITH, M. D., C. J. COURTNEY, AND L. A. ELLIS. 2005. Burrowing Owl nesting productivity: a comparison between artificial and natural burrows on and off golf courses. Wildlife Society Bulletin 33:454–462.

VAN BALEN, J. H., C. J. H. BOOY, J. A. VAN FRANEKER, AND E. R. OSIECK. 1982. Studies on hole-nesting birds in natural nest sites-availability and occupation of natural nests. Ardea 70:1–24.

WHITE, R. J. AND B. F. BLACKWELL. 2003. Ineffectiveness of sulfur-based odors as nesting deterrents against European Starlings. Ohio J. Science 103:126–128.