BULLETIN OF THE
OKLAHOMA ORNITHOLOGICAL SOCIETY
VOL. 43 SEPTEMBER 2010 NO. 3

BISON HAIR REDUCES PREDATION ON ARTIFICIAL BIRD NESTS

BRYAN R. COPPEDGE

Tulsa Community College – West, 7505 W. 41st St., Tulsa, Oklahoma 74107; E-mail: bcoppedg@tulsacc.edu

Abstract—The use of bison hair by birds nesting at the Tallgrass Prairie Preserve (TGPP) in Osage County led me to hypothesize that bison hair might function as nest camouflage via scent-masking. I conducted 2 artificial nest experiments from late April to early July 2007 in which one-half of the nests were lined with bison hair collected from the residential herd at the TGPP; remaining nests served as controls. Nest predation was significantly higher on unlined control nests than hair-lined nests when located on the ground. There was no difference in predation rates between nest types when located in shrubs and trees. Use of materials such as bison hair may mask nest odors and thus be a novel and indirect method of predator avoidance by birds nesting at the TGPP.

Birds often incorporate unusual materials into their nest based on potential benefits provided to the nesting environment (Hansell 2000). For example, Burrowing Owls (*Athene cunicularia*) line their nest tunnels with cattle dung to attract dung beetles, a food source for nestlings (Levey et al. 2004). In African grasslands, the Common Waxbill (*Estrilda astrild*) places carnivore dung near its nest as olfactory camouflage and as a deterrent for predators by concentrating the scent of other predators in the nest vicinity (Schuetz 2004).

Three hundred bison (*Bison bison* L.) were reintroduced into the Tallgrass Prairie Preserve (TGPP), a 15,500-ha grassland area owned and managed by The Nature Conservancy 25 km north of Pawhuska, Oklahoma, in 1993 (Hamilton 2007). I recently documented the prevalence and patterns of bison hair use by passerines nesting in the TGPP and reported that 13 species used bison hair in their nests and 42% of nests examined contained bison hair (Coppedge 2009). The prevalence of bison hair use in nests in this avian community led me to hypothesize that bison hair might also function as nest camouflage by scent-masking the nest location or olfactory cues emanating from nest contents (Conover 2007). I report herein on the results of an artificial nest study examining the influence of bison hair incorporation on the relative risk of nest predation. My working hypothesis was that a bison hair lining enhanced nest concealment from olfactory-searching predators, resulting in lower predation rates than unlined control nests.

I conducted 2 experiments at the TGPP that encompassed a series of 6 trials conducted from late April to early July 2007. Each trial consisted of 20 artificial nests placed at random intervals perpendicular to the axis of a 400-m transect located in an area unburned for ≥ 1 year. Availabilities of quail eggs and field crews and time necessary to construct nests restricted the number of concurrent trials to 1 per experi-

ment. Transects were located ≥ 1 km apart, and the minimum distance between any 2 nests was ≥ 20 m. Nest sites were unmarked and relocated only by the distance from the transect axis and notable vegetation. Field crews wore rubber boots and gloves when handling and deploying all experimental materials to discourage potential predators from following investigator scent lines, and no direct dead-end paths were made to any nest site (Martin and Geupel 1993).

Artificial nests were constructed of grass stems and leaves woven into a cup shape 10 cm in diameter. Nests were aired outdoors for 4 weeks prior to deployment to minimize any unusual odors that might attract predators (Whelan et al. 1994). In the each experiment, one-half of the nests were lined with ~0.3 g of sloughed bison hair collected from areas frequented by the resident herd at the TGPP. I used that amount because it equaled the mean amount of bison hair found in nests in my earlier survey (Coppedge 2009). In the first experiment ("shrub nests"), nests were placed 30–50 cm aboveground in shrubs and vines to simulate nests of aboveground nesters such as Red-winged Blackbirds (*Agelaius phoeniceus*) and Dickcissels (*Spiza americana*). Each nest was wired to a supporting branch to prevent wind dislodgment and baited with 2 fresh infertile eggs of Blue Quail (*Coturnix adansonii*). In the second experiment ("ground nests"), nests were placed on the ground to simulate nests of Grasshopper Sparrows (*Ammodramus savannarum*). All nests were checked on days 5, 10, and 15, the end of the trial. Nests were considered depredated if ≥ 1 egg was removed or destroyed. I examined 3 nest predation-related variables; overall predation rate, length of nest survival, and probability of survival. Effect of nest treatment (hair-lined or control) on overall predation rate was tested with likelihood ratio chi-square (G^2) following Agresti (1996). Length of nest survival was defined as 15 days if the nest was undisturbed, or as the number of days since set-up to the midpoint between the day a nest was found depredated and the earlier check day. Effect of nest treatment on length of nest survival (in days) was tested with Wilcoxon rank sum tests. Probabilities of nest survival were calculated following Mayfield (1976) with 95% confidence intervals calculated following Johnson (1979).

In the shrub nest experiment ($N = 120$), 40.0% of hair-lined nests and 38.3% of control nests were depredated. These rates were not significantly different ($G^2 = 0.035$, $d.f. = 1$, $P = 0.8516$). Mean length of survival for shrub nests did not differ ($z = 0.169$, $P = 0.4412$) between treatments (hair-lined nests, 11.3 days ± 0.67 *SE*; control nests, 10.9 days ± 0.73). Daily survival probabilities for shrub nests were nearly identical for hair-lined (0.973 ± 0.011) and control nests (0.974 ± 0.011). Cumulative (15 day) survival also was similar between hair-lined (66%) and control (67%) nests.

In the ground nest experiment ($N = 120$), 33.3% of hair-lined nests and 55.0% of control nests were depredated. These rates were significantly different ($G^2 = 5.76$, $d.f. = 1$, $P = 0.0164$). Mean length of survival for ground nests also differed ($z = 2.798$, $P = 0.0025$) between treatments, with hair-lined nests surviving depredation 3 days longer (12.3 days ± 0.59) than control nests (9.3 days ± 0.73). Daily survival probabilities for ground nests did vary slightly between hair-lined (0.977 ± 0.009) and control nests (0.963 ± 0.013), but cumulative (15 day) survival was notably higher for hair-lined (71%) than for control nests (57%).

The experimental use of artificial nests in studies of predator behavior and search image formation is deemed worthwhile as preliminary steps to understanding localized nest predation (Faaborg 2004). Nevertheless, 1 of the most common criticisms of artificial nests studies is that they often overestimate predation rates relative

to real nests (Major and Kendal 1996). I found 33–55% of artificial ground nests were depredated, an amount just below the 50–62% rate of nest losses of Eastern Meadowlark (*Sturnella magna*) to predators at the TGPP (Rohrbaugh et al. 1999). Shrub nest losses of ca. 40% in my study were lower than studies of real nests done in the area where losses were 60–75% (Rohrbaugh et al. 1999, Shochat et al. 2005). Furthermore, lack of differences in depredation rates between nest treatments for shrub nests was consistent with previous studies showing that above-ground, open-cup nests are usually depredated by avian predators (Santisteban et al. 2002). Thus, olfactory cues such as added bison hair should have little effect on predation relative to visual cues (Rangen et al. 2000). Ground nests are primarily depredated by olfactory-searching, nocturnal mammals (Whelan et al. 1994), and ground-nesting birds use a number of strategies to decrease olfactory signals emitted during nesting. Many birds quickly remove eggshells and fecal sacs from their nests to reduce cues predators could use to locate nests (Sordahl 2006). Ground-nesting Red Knots (*Calidris canutus*) even change the chemical composition of their preening wax to a form less detectable by olfactory-searching predators (Reneerkens et al. 2005). Using materials such as sloughed bison hair by grassland birds at the TGPP may mask nest odors and their use might function to reduce nest detection and predation. My hypothesis that adding bison hair to nests would decrease predation was supported in part by the results of the ground nest experiment. Future work will focus on examining the effects of bison hair on real nest success.

Acknowledgements.—Support for this work was provided by the Oklahoma Ornithological Society. I thank J. Locut and L. Coppedge for their assistance in conducting this study.

Literature Cited

Agresti, A. 1996. An introduction to categorical data analysis. John Wiley and Sons, New York.

Conover, M. R. 2007. Predator-prey dynamics: the role of olfaction. CRC Press, Boca Raton, Florida.

Coppedge, B. R. 2009. Patterns of bison hair use in nests of tallgrass prairie birds. Prairie Naturalist 41:110–115.

Faaborg, J. 2004. Truly artificial nest studies. Conservation Biology 18:369–370.

Hamilton, R. G. 2007. Restoring heterogeneity on the Tallgrass Prairie Preserve: applying the fire-grazing interaction model. Pp. 163–169 *in* Proceedings of the 23rd Tall Timbers Fire Ecology Conference: Fire in grassland and shrubland ecosystems (R. M. Masters and K. E. M. Galley, eds.). Tall Timbers Research Station, Tallahassee, Florida.

Hansell, M. 2000. Bird nests and construction behavior. Cambridge University Press, Cambridge, England.

Johnson, D. H. 1979. Estimating nest success: the Mayfield method and an alternative. Auk 96:651–661.

Levey, D. J., R. S. Duncan, and C. F. Levins. 2004. Use of dung as a tool by burrowing owls. Nature 431:39.

Major, R. E., and C. E. Kendal. 1996. The contribution of artificial nest experiments to understanding avian reproductive success: a review of methods and conclusions. Ibis 138:298–307.

Martin, T. E., and G. R. Geupel. 1993. Nest-monitoring plots: methods for locating nests and monitoring success. Journal of Field Ornithology 64:507–519.

Mayfield, H. 1976. Suggestions for calculating nest success. Wilson Bulletin 87:456–466.

Rangen, S. A., R. G. Clark, and K. A. Hobson. 2000. Visual and olfactory attributes of artificial nests. Auk 117:136–146.

Reneerkens, J., T. Piersma, and J. A. S. Damste. 2005. Switch to diester preen waxes may reduce avian nest predation by mammalian predators using olfactory cues. Journal of Experimental Biology 208:4199–4202.

Rohrbaugh, R. W., D. L. Reinking, D. H. Wolfe, S. K. Sherrod, and M. A. Jenkins. 1999. Effects of prescribed burning and grazing on nesting and reproductive success of three grassland passerines species in tallgrass prairie. Studies in Avian Biology 19:165–170.

Santisteban, L., K. E. Sieving, and M. L. Avery. 2002. Use of sensory cues by fish crows *Corvus ossifragus* preying on artificial bird nests. Journal of Avian Biology 33:245–252.

Schuetz, J. G. 2004. Common waxbills use carnivore scat to reduce the risk of nest predation. Behavioral Ecology 16:133–137.

Shochat, E., D. H. Wolfe, M. A. Patten, D. L. Reinking, and S. K. Sherrod. 2005. Tallgrass prairie management and bird nest success along roadsides. Biological Conservation 121:399–407.

Sordahl, T. 2006. Field experiments on eggshell removal by mountain plovers. Wilson Journal of Ornithology 118:59–63.

Whelan, C. J., M. L. Dilger, D. Robson, N. Hallyn, and S. Dilger. 1994. Effects of olfactory cues on artificial-nest experiments. Auk 111:945–952.

Submitted 16 December 2009; accepted 2 February 2010.

The *Bulletin of the Oklahoma Ornithological Society* (ISSN 0474-0750) is published quarterly in March, June, September, and December in Norman, Oklahoma. Co-editors, Bryan Coppedge (to whom manuscripts should be directed), Science and Mathematics, Tulsa Community College, 7505 West 41st Street, Tulsa, OK 74107-8633 e-mail: bcoppedg@tulsacc.edu; Jeffrey F. Kelly, University of Oklahoma; and David M. Leslie, Jr., U.S. Geological Survey. Subscription is by membership in the Oklahoma Ornithological Society: $15 student, $25 regular, $35 family, $40 or more sustaining, per year; life membership, $500. Direct questions regarding subscription, replacement copies, back issues, or payment of dues to Don Glass, OOS Membership/Circulation Chair, P.O. Box 2931, Claremore, OK 74018.