SUPPLEMENTAL FEEDING AND NEST PREDATION

TIM F. GINNETT, Texas A&M University Research and Extension Center, 1619 Garner Field Road, Uvalde, TX 78801, Email:t-ginnett@tamu.edu

SUSAN M. COOPER, Texas A&M University Research and Extension Center, 1619 Garner Field Road, Uvalde, TX 78801.

Abstract: Intensive deer management activities, including supplemental feeding, are increasingly popular on private lands in Texas. Racoons (*Procyon lotor*), skunks (*Mephitis mephitis*), and other small predators are highly attracted to deer feeders. We conducted a three-year study to determine whether concentrating small predators near deer feeders could be detrimental to ground-nesting birds such as wild turkeys. We used two sites with open choice deer feeders and two control sites. Levels of nest predation were determined by monitoring the fates of artificial nests consisting of three chicken eggs. Nest predation was much higher at sites containing deer feeders and we assigned the majority of nest predation events to racoon predation. Differences in nest predation between feeder sites and control sites was greatest during wet years when adequate screening cover for nests was available.

Supplemental feeding of white-tailed deer is a very common management practice in Texas. Shelled corn or alfalfa-based pellets are generally provided in free-choice feeders that may or may not be fenced from livestock or feral hogs. Deer feeders attract a host of non-target species, including livestock, racoons, skunks, ringtails, foxes, opossums, porcupines, squirrels, rabbits, hogs, javelinas, turkeys, and numerous songbirds (Rollins 1996). Some of these species, racoons in particular, are serious nest predators of ground nesting birds.

We undertook a 3-year study using artificial nests (Major and Kendal 1996) to determine whether open-choice deer feeders could pose a risk to nesting success of ground-nesting birds in the vicinity of deer feeders. This paper is a summary of our previously published results (Cooper and Ginnett 2000).

METHODS

This study was conducted on the Harris Ranch in Uvalde, County, Texas. The ranch consists of approximately 16,000 acres vegetated mainly by guahillo (*Acacia berlandieri*) and other low acacias, cenizo, and mesquite (*Prosopis glandulosa*). Scattered oak *(Quercus virginiana*) mottes exist primarily in drainages. The predominant land uses are white-tailed deer hunting and cow-calf cattle grazing.

We established two treatment sites consisting of an open-choice feeder, and two control sites without feeders. The four sites were chosen on the basis of habitat similarity. Each of the four sites was centered on a water source; either a pond or windmill with water trough. Feeders were supplied with shelled corn for several weeks prior to the start of the experiment.

On April 1st of 1997, 1998, and

1999, we established an 800 m by 40 m belt transect at each site, centered on the feeder. Within the transect, 50 artificial nests, each consisting of three chicken eggs, were set out randomly, with the constraint that the nests be located in vegetation typical of a wild turkey nest site (i.e. cover taller than 0.5 m. The nests were monitored for 28 days, corresponding to the natural incubation period for turkeys. We considered a nest predated if one or more eggs were missing from the nest. In 1997 and 1998, fed and unfed sites were reversed. This was done to avoid confounding feeding treatments with potential differences inherent to each site. We used Trailmaster cameras and hair traps (Stains 1958) to identify potential nest predators using the feeders.

During 1998 we experienced extreme drought conditions where little or no nesting cover was produced. This resulted in nearly 100% predation of the artificial nests regardless of treatment so we extended the study to 1999. The 1999 sites were kept the same as in 1998. We used standard survival analysis techniques to analyze the data (Le 1997).

RESULTS

As previously mentioned during 1998 the lack of nesting cover resulted in virtually 100% predation of artificial nest regardless of whether or not a feeder was present. Therefore, most comparisons that we report here include only 1997 and 1999 data. Overall predation rates are depicted in Figure 1. Nest predation rates were greater at sites with feeders compared to control sites (86% vs. 58.5%, Wald $\chi^2 = 30.1$, 1 df, $P \leq 0.001$). Predation rates were greater during 1999 than in 1997 (85% vs. 58.5%, Wald $\chi^2 = 16.4$, 1 df, $P \leq 0.001$). A greater proportion of nests was predated at windmill sites vs. pond sites 79.5% vs. 64%, Wald $\chi^2 = 4.3$, 1 df, $P = 0.04$).

Survival curves for feeder sites and control sites each year are presented in Figure 2. For this analysis, data were pooled across the two replicate sites for each treatment within each year. With the exception on 1998, survival curves for sites with feeders were significantly lower than for control sites (Cox's F test, $P \leq 0.002$).

Weather conditions appeared to influence nest predation (Figure 3). During 1998 when precipitation was lowest, nest predation was uniformly high. In the wettest year, 1997, predation rates were lowest. During 1999, which was intermediate in terms of precipitation, predation rates were also intermediate. Interestingly, the difference in predation rates between feeder sites and control sites increased with increasing precipitation.

Hair traps and automatic cameras that we put out at feeders and some nest sites indicated that racoons, skunks, grey foxes and opossums were the most common small predators. Racoons were by far the most visitor to the feeders; often 7 or more would be at the feeders simultaneously. Cattle and also white-tailed deer were photographed investigating nests but we did not have any indication that they took or destroyed eggs. A Harris's hawk (*Parabuteo unicintus*) was also photographed at a nest.

DISCUSSION

We found that nests in the vicinity of deer feeders were at a greater risk of discovery by small predators. This effects was greatest during wet years when more covering vegetation was produced. Our crossover design in which we switched supplemented and non-supplmented sites between years assured that the effect we measured was a real phenomenon, and not an artifact of unmeasured differences between sites.

Ranson et al. (1987) have argued that artificial nests are an acceptable substitute for real nests when studying predation of large ground-nesting birds like turkeys. However, use of artificial nests has been criticized on several grounds. First, artificial nests tend to suffer greater predation rates than natural nests (Major and Kendal 1996, Butler and Rotella 1998). Because we were interested in determining the relative effect (rather than absolute predation rates) of a management practice while controlling other factors as much as possible, we designed our study so that any potential biases due to the artificial nests were the same over all treatments. By exchanging the supplemented and non-supplemented sites between years, we assured that the greater nest predation we observed at the supplemented sites was a real phenomenon and not an artifact of unmeasured environmental differences between sites. Second, it is possible that artificial nests attract a different group of predators than natural nests (Major and Kendal 1996, Butler and Rotella 1998). In our case, hair traps and cameras showed that predators attracted to both the feeders and artificial nests were also the predators most responsible for predation on natural turkey nests (Miller and Leopold 1992).

Results obtained during the dry spring of 1998 indicated that lack of nesting cover probably outweighs any deleterious effects caused by the deer feeders. When ground cover was sparse, predation rates on artificial nests were extremely high at supplemented and non-supplemented sites. Vander Lee et al. (1999) also found that greater vegetation density reduced the likelihood of predation on artificial nests. It has been suggested, though, that lack of vegetative cover affects the success of artificial nests more than natural nests, which are camouflaged by the parent bird (Butler and Rotella 1998). In support of our findings, however, poor juvenile recruitment of wild turkeys is commonly observed in Texas during drought years (Beasom and Pattee 1980).

According to Hernandez et al. (1996*a*), eggshell breakage patterns may be indicative of the predator involved. They found that raccoons left eggs that were broken in half or into a few large fragments or alternatively crushed into small fragments. Eggs with holes in the side were more likely preyed upon by either skunks, foxes, or bobcats. Based on these criteria, 64.7 % of the predated nests in our study were likely raccoon predation, 11.7 % either skunks, foxes, or bobcats, and 23.6 % unknown predators. Lack of variation in frequency of egg-shell breakage patterns among sites suggests that the suite of nest predators was similar across the study area.

Providing supplemental food for predators has been suggested as a means to reduce skunk predation of duck eggs (Crabtree and Wolfe 1988). In support of this, Vander Lee et al. (1999) found that providing predators with supplemental prey reduced predation on artificial nests. In their study, supplemental prey were supplied adjacent to areas with artificial nests, rather than within areas containing artificial nests as in our study. It is clear that the spatial arrangement of feeders relative to nest sites is critical for this technique to succeed. We also echo the caveat given by Clark et al. (1996) that increased nutrition of predators through supplemental feeding could lead to increased productivity, survival, and ultimately, increased populations of predators in the habitat.

Another possible alternative is to attempt to control raccoons and other nest predators. However, Goodrich and Buskirk (1995) caution that removal of native predators often has unforseen ecological consequences extending beyond the protection of the prey species of concern. For example, raccoons are omnivores and primarily consume plants, seeds, and invertebrates. They therefore have a far-reaching role in community and ecosystem interactions (Ratnaswamy and Warren 1998).

Perhaps the safest and easiest option for managers to reduce the potential predation risk to ground nesting birds may be to place deer feeders away from turkey nesting habitat. Wild Rio Grande turkeys typically nest within 400 m of water and 840 m of tall roosting trees (Ransom et al. 1987). Similar habitat also is attractive to raccoons (Rabinowitz and Pelton 1986). Placing deer feeders at such sites is likely to attract raccoons and other nest predators and increase predation pressure on turkeys and other ground-nesting birds.

In summary, we suggest that deer feeders should not be placed in good wild turkey nesting habitat or that the feeders should be left empty in springtime when the turkeys have eggs and small poults, which are susceptible to predation by raccoons.

Acknowledgments. We thank R. Cooper, R. Gonzalez, R. Osborn, and D. Kunz for field assistance. M. Harris kindly allowed us the use of his ranch. Funding for this project was provided by the Rachael and Ben Vaughan Foundation, and by USDA Hatch Project TEXO8483.

.

LITERATURE CITED

Beasom, S. L., and O. H. Pattee. 1980. The effect of selected climatic variables on wild turkey productivity. Proceedings of the National Wild Turkey Symposium 4:127–135.

Butler, M. A., and J. J. Rotella. 1998. Validity of using artificial nests to assess duck-nest success. Journal of Wildlife Management 62:163–171.

Clark, R. G., K. L. Guyn, R. C. N. Penner, and B. Semel. 1996. Altering predator foraging behavior to reduce predation of ground nesting birds. Transactions of the North American Wildlife and Natural Resources Conference 61:118–126.

Cooper, S.M. and T. F. Ginnett. 2000. Potential effects of supplemental feeding of deer on nest predation. Wildlife Society Bulletin 28:660-666.

Crabtree, R. L., and M. L. Wolfe. 1988. Effects of alternate prey on skunk predation of waterfowl nests. Wildlife Society Bulletin 16:163–169.

Goodrich, J. M., and S. W. Buskirk. 1995. Control of abundant native vertebrates for conservation of endangered species.

Conservation Biology 9:1357–1364.

Hernandez, F. , D. Rollins, and R. Cantu. 1997*a*. Evaluating evidence to identify ground-nesting predators in west Texas. Wildlife Society Bulletin 25:826–831.

Hernandez, F. , D. Rollins, and R. Cantu. 1997*b*. An evaluation of Trailmaster camera systems for identifying ground-nest predators. Wildlife Society Bulletin 25:848–853.

Le, C. T. 1997. Applied survival analysis. John Wiley & Sons, New York, New York, USA.

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.

Miller, J. E., and B. D. Leopold. 1992. Population influences: Predators. Pages 119–128 *in* J. D. Dickson, editor. The wild turkey: biology and management. Stackpole, Mechanicsburg, Pennsylvania, USA.

Ransom, D. Jr., Rongstad O. J., and Rusch D. H. 1987. Nesting ecology of Rio Grande turkeys. Wildlife Society Bulletin 51:435–439.

Ratnaswamy, M. J., and Warren R. J. 1998. Removing raccoons to protect sea turtle nests: are there implications for ecosystem management? Wildlife Society Bulletin 26:846–850.

Rollins, D. 1996. Evaluating a deer feeding program: biological and logistical concerns. Pages 67-73 *in* Symposium proceedings. Supplemental feeding for deer: beyond dogma. Texas A&M University System, 8-10 October 1996, Kerrville, USA.

Stains, H. J. 1958. Field guide to guard hairs of middle western furbearers. Journal of Wildlife Management 22:95-97.

Vander Lee, B. A., R. S. Lutz, L. A. Hansen, and N. E. Mathews. 1999. Effects of supplemental prey, vegetation, and time on success of artificial nests. Journal of Wildlife Management 63:1299–1305.

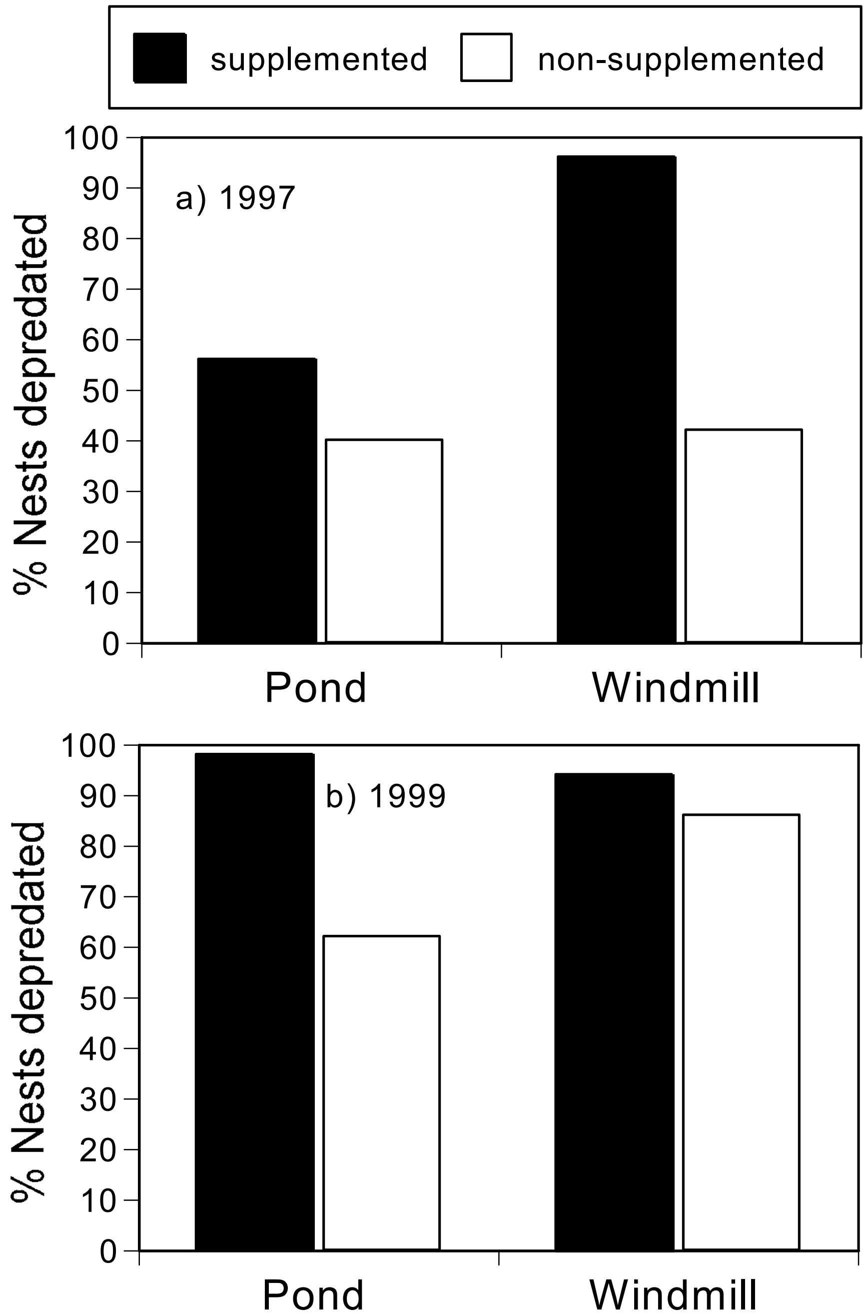

Figure 1. Percentage of artificial nests depredated after 28 days. Sites with feeders had consistently greater predation rates than sites without feeders.

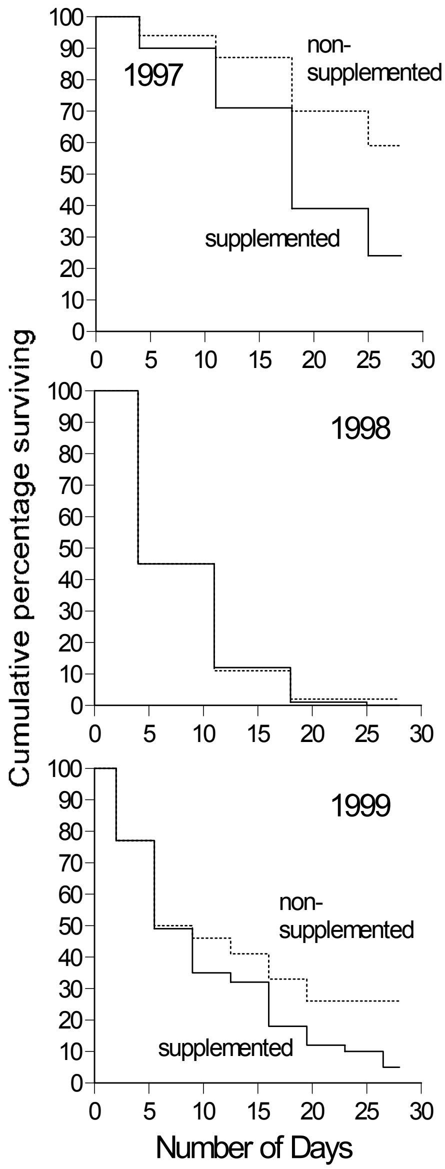

Figure 2. Composite Kaplan-Meier survival curves for artificial nests at supplemented and nonsupplemented sites for each year. Survival curves for supplemented and nonsupplemented sites differed significantly during 1997 and 1999 but not during 1998.

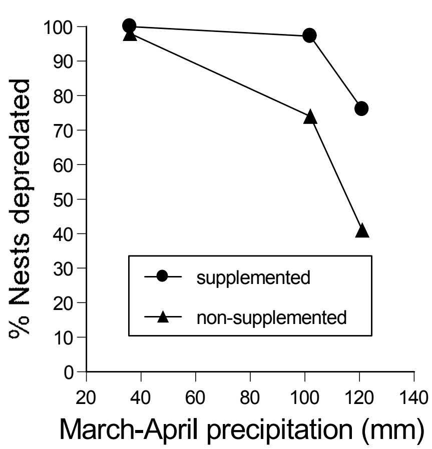

Figure 3. Relationship between precipitation and predation rates on artificial nests.