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Predation on Artificial Turkey Nests at Radford Army Ammunition Plant in Western Virginia

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ABSTRACT

Because ground-nesting wild turkeys (*Meleagris gallopavo*) may sustain high incidences of nest predation in western Virginia, determining their predators is essential to understanding risk and managing the birds. Our study investigated potential predators of wild turkey nests at the Radford Army Ammunition Plant, New River Unit (RFAAP; Pulaski Co., in western Virginia). Here, we established 8 artificial nests during the breeding season for wild turkey (March-April, 2017), and documented predators via game cameras. Thirty-one species of mammals and birds visited the nests over the 31-day study. Nest predation was verified 56 times across 6 species, including coyotes (*Canis latrans*), a relatively new addition to the RFAAP. Most egg loss was attributed to mesocarnivores—raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), and Virginia opossums (*Didelphis virginiana*)—but eastern fox squirrels (*Sciurus niger*) and American crows (*Corvus brachyrhynchos*) were predators, too. Because these nests were artificial and unguarded, further studies will elucidate predation risks to wild turkeys at the RFAAP. The RFAAP offers the unique opportunity to further study this predator-prey relationship, as hunting for wild turkey and the predators recognized in this study is not permitted on the property.

INTRODUCTION

By knowing and understanding the natural history of a game species, and the habitat in which it exists, managers can determine how best to manage a population, and which management techniques might maintain or increase the population size. In the case of the wild turkey (*Meleagris gallopavo*) in southwestern Virginia, it is possible that populations are controlled by bottom-up (food limitations, secure nest space) or top-down (predation to nests, poults, and adults) factors (Roberts and Porter 1996, Lariviere 1999), or a combination of the two pressures (Norman et al. 2001).

At the Radford Army Ammunition Plant's (RFAAP) New River Unit (Pulaski Co., western Virginia), resource managers work with the Virginia Department of Game and Inland Fisheries (VDGIF) to follow the principles of Quality Deer Management (QDM; VDGIF 2017a) to manage the 1101-ha property, in part, for white-tailed deer (*Odocoileus virginianus*). In doing so, other game species undoubtedly benefit from bottom-up QDM management efforts, e.g., the introduction of food plots benefit other browsers and granivores. Wild turkeys are common visitors to these managed food plots (Powers, personal observation). However, no investigations to date have looked at top-down controls of the population of wild turkeys on the property.

Hernandez et al. (1998) reported raccoons (*Procyon lotor*) as the principle predators of turkey nests in Texas, and secondary predators included bobcats (*Lynx rufus*), striped skunks (*Mephitis mephitis*), gray foxes (*Urocyon cinereoargenteus*), and Virginia opossums (*Didelphis virginiana*). Occasional predators of wild turkey nests included turkey vultures (*Cathartes aura*), woodrats (*Neotoma*), and other wild turkeys (Hernandez et al. 1998). The Virginia Department of Game and Inland Fisheries (2014) lists bobcats as the primary mammalian predator of wild turkeys, although raccoons have greater success as nest predators. Raptors, primarily great horned owls (*Bubo virginianus*), also feed on wild turkeys, and American crows (*Corvus brachyrynchos*) are significant nest predators (VDGIF 2014).

At the RFAAP, surveys of predatory mammals (not specific to wild turkeys) were completed in 2003 (Convery and Klopfer 2003) via camera trap surveys, track surveys, and scent stations. At that time, red (*Vulpes vulpes*) and gray foxes were the largest canids confirmed on the property. From 2012-2014, 17 months of camera trap surveys by Powers and students (Powers, unpublished data) confirmed the presence and establishment of the coyote (*Canis latrans*). These canids have been observed in photographs (via camera traps) in packs of up to five individuals, and unique identification of individual coyotes indicate that these canids are distributed across the entire 1101-ha property (Powers, personal observation).

Based on this food web alteration since the 2003 surveys (Convery and Klopfer 2003), we began an investigation of the presumed impact of coyotes (and other potential predators) on wild turkey reproductive success. As a first step to answering this question, we established artificial nests similar to those of wild turkeys in suitable habitat. Our objectives were to document all predatory species and to determine the relative "risk" by the different potential egg predators at the RFAAP. Because artificial nests are a common method for wildlife biologists to determine the relative costs of predation (e.g., Hernandez et al. 1998, Yahner and Wright 1985), we monitored these nests with wildlife game cameras to determine if coyotes were the primary predator of eggs, or if other mammalian or avian predators contributed more to nest loss.

MATERIALS AND METHODS

We established and monitored 8 artificial nest sites on the RFAAP's New River Unit for 31 nights, March 3 to April 3, 2017. We created nests by making slight depressions (about 2.5 cm deep, 20-28 cm wide, and 23-33 cm long) in the ground at the base of shrubs or in a clump of dense grasses with considerable horizontal cover and light overhead cover. Each depression was lined with ground litter (Donalty and Henke 2001). Nests were baited with 8 unwashed chicken eggs that simulated the size and shape of wild turkey eggs. Motion- and thermal-triggered

Reconyx Hyperfire (Holman, WI) and Simmons Whitetail 4MP (Overland Park, KS) cameras provided 24-h surveillance, and 2-4 cameras per nest were set to maximize detection from multiple angles. Although ideal protocol would have stipulated that nests be checked daily to immediately re-bait or move predated sites, the logistics of working at a limited-access army installation precluded such an effort. Instead, sites were checked and rebaited (if necessary) every 2-9 days.

Analysis of camera images began with a count of visits to nests. A visit was defined as any animal captured on camera, and visits by an individual were considered unique if more than 30 min had elapsed since the last detected visit (Hernandez et al. 1998). Because this project was strictly observational, and not mark-recapture, we were unable to determine if individuals were repeat predators. Next, we counted the number verified predation attempts in which images depict an individual carrying or consuming eggs. Finally, predation risk was calculated as the number of predation attempts divided by the number of visits. This provided a metric as to the threat a species might pose if it happened upon an unguarded nest. If the risk = 1, we presume that every time an individual of that species detected a nest, it preyed upon it. As the risk approached zero, we concluded that nests were predated less often, or the species posed no threat to the nest.

RESULTS

Fifteen avian and 16 mammalian species were photographed in the vicinity of the nests (Table 1, Figure 1). The most frequent visitors to the turkey nests were white-tailed deer (n = 63), raccoons (n = 61), striped skunks (n = 28), deer mice (*Peromyscus maniculatus*)/white-footed mice (*P. leucopus*; n = 28) and eastern cottontails (*Sylvilagus floridanus*; n = 25). Of these most frequent visitors to the turkey nests, only raccoons and striped skunks actively preyed upon the nests. Fifty-six nest predation events were documented from 6 species: 1 bird (American crow), and 5 mammals (coyote, raccoon, striped skunk, Virginia opossum, eastern fox squirrel [*Sciurus niger*]; Table 1). While coyotes were confirmed to be one of the 6 species that predated the turkey nests, the total number of coyote predation attempts (n= 2) was lower than those of raccoons (n = 35), striped skunks (n = 10), and Virginia opossums (n = 4). Based on the relative predation risk, coyotes posed the greatest risk to nests (0.667). Predation risk rates were lower for raccoons (0.574), Virginia opossums (0.400), American crows (0.375), striped skunks (0.357), and eastern fox squirrels (0.200; Table 1).

DISCUSSION

Wildlife managers and private landowners in Virginia often set goals for maintaining or increasing local populations of particular game species. This project provided further information about the presumed impacts of both recent (coyote) and established predators of wild turkey nests in this region, which is essential to managing this species (Larivière 1999). Multiple avian and mammalian predators could influence turkey reproductive success, if their responses to undefended artificial nests are an indicator of real predation risk (Yahner and Wright 1985, Major and Kendall 1996, Hernandez et al. 1998).

Although coyotes were detected only 3 times in the 31-night survey, they preyed upon the nests during 2 of the 3 visits. This was a greater proportion than all other predators, suggesting a greater risk factor for coyotes than others. This does not negate the influence of the smaller predatory species, which documented 49 predation events and comprised the majority of observed predation events. Raccoons are the primary nest predators of wild turkeys in Virginia (VDGIF 2014). However, results of our study with photographic evidence of 6 predatory species, suggests wild turkeys are threatened by many nest predators.

We acknowledge there were limitations to this short-term study. First, due to the artificiality, the lack of nest guarding by wild turkeys could be a concern, because the female has the some ability to defend the nest; but, not all female turkeys will actively defend their nest, especially when they are disrupted while egg laying or early in the incubation period (VGDIF 2014). Nevertheless, artificial nest studies in wildlife are seen as useful (e.g., Major and Kendal 1996). We also recognize that stationary nests do not fully reflect reality. For example, after our nests were predated, we rebuilt/re-baited them with eggs in the same location. This could have encouraged return visits by individuals that had previously predated the nest. Although females with nest failures do frequently re-nest, with some success, it is unclear whether they move nests or nest in the same locale (Miller et al. 1998, Harper and Exum 1999). Finally, our study is a 31-day snapshot in time; longer-term studies might better assess the role of wild turkeys (as eggs, poults, and adults) in predator diets.

Despite these acknowledged limitations, the findings documented that coyotes, a relative newcomer to the RFAAP, could potentially impact wild turkey nesting success at this site. Although wild turkeys are not actively hunted on this installation, the surrounding property is private lands where hunting is permitted. However, none of the predators in this study are hunted on the installation. Coyotes are hunted without bag limits in western Virginia (Morin 2015), while the remaining five species have seasonal or continuous hunting seasons (VDGIF 2017b). Therefore, determining if the RFAAP serves as a source or sink population for wild turkeys is a valid question for future management studies.

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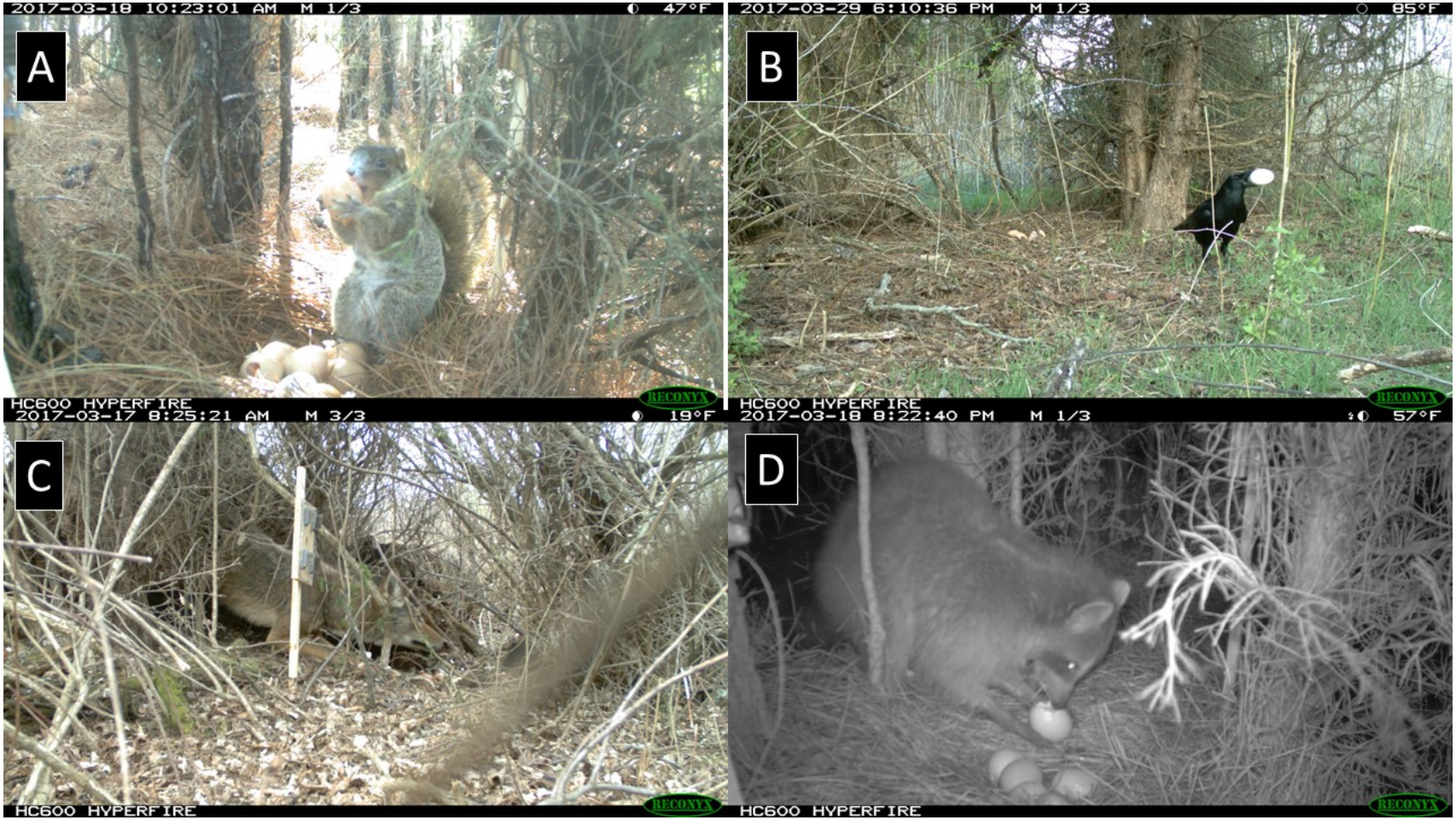
Table 1: Species detected (No. of visits) at 8 artificial turkey nests at the Radford Army Ammunition Plant, New River Unit (Pulaski Co., Virginia) in March-April 2017. Listed are predation attempts (individual carrying or consuming eggs) and relative predation risk (predation attempts/no. visits).

Order	Family	Scientific name	Common name	Visits (No.)	Predation attempts (No.)	Predation risk
Class Mammalia						
Artiodactyla	Cervidae	*Odocoileus virginianus*	White-tailed Deer	63	0	0
Carnivora	Canidae	*Canis latrans*	Coyote	3	2	0.667
Carnivora	Canidae	*Urocyon cinereoargenteus*	Gray Fox	3	0	0
Carnivora	Didelphidae	*Didelphis virginiana*	Virginia Opossum	10	4	0.4
Carnivora	Felidae	*Felis catus*	Domestic or Feral Cat	8	0	0
Carnivora	Mephitidae	*Mephitis mephitis*	Striped Skunk	28	10	0.357
Carnivora	Mustelidae	*Mustela frenata*	Long-tailed Weasel *	2	0	0
Carnivora	Mustelidae	*Neovison vison*	American Mink *	1	0	0
Carnivora	Procyonidae	*Procyon lotor*	Raccoon	61	35	0.574
Carnivora	Ursidae	*Ursus americanus*	American Black Bear	1	0	0
Lagomorpha	Leporidae	*Sylvilagus floridanus*	Eastern Cottontail	25	0	0
Rodentia	Cricetidae	*Peromyscus leucopus/ P. maniculatus*	White-footed Mouse/ Deer Mouse	28	0	0
Rodentia	Sciuridae	*Marmota monax*	Woodchuck	1	0	0
Rodentia	Sciuridae	*Sciurus carolinensis*	Eastern Gray Squirrel	6	0	0
Rodentia	Sciuridae	*Sciurus niger*	Eastern Fox Squirrel	10	2	0.2
Rodentia	Sciuridae	*Tamias striatus*	Eastern Chipmunk	1	0	0
Class Aves						
Charadriiformes	Scolopacidae	*Scolopax scolopax*	American Woodcock **	10	0	0
Columbiformes	Columbidae	*Zenaida macroura*	Mourning Dove	1	0	0

Order	Family	Scientific Name	Common Name	Visits (No.)	Predation attempts (No.)	Predation "Risk"
Galliformes	Phasianidae	*Meleagris gallopavo*	Wild Turkey	11	0	0
Passeriformes	Corvidae	*Corvus brachyrhynchos*	American Crow	8	3	0.375
Passeriformes	Corvidae	*Cyanocitta cristata*	Blue Jay	2	0	0
Passeriformes	Cardinalidae	*Cardinalis cardinalis*	Northern Cardinal	10	0	0
Passeriformes	Emberizidae	*Pipilo erythrophthalmus*	Eastern Towhee	2	0	0
Passeriformes	Emberizidae	*Zonotrichia albicollis*	White-throated Sparrow	7	0	0
Passeriformes	Mimidae	*Mimus polyglottos*	Northern Mockingbird	7	0	0
Passeriformes	Mimidae	*Toxostoma rufum*	Brown Thrasher	7	0	0
Passeriformes	Troglodytidae	*Thryothorus ludovicianus*	Carolina Wren	1	0	0
Passeriformes	Turdidae	*Turdus migratorius*	American Robin	6	0	0
Passeriformes	Tyrannidae	*Sayornis phoebe*	Eastern Phoebe	2	0	0
Piciformes	Picidae	*Melanerpes carolinus*	Red-bellied Woodpecker	3	0	0

*Confirmed presence denotes new county record
**Confirmed presence denotes new seasonal record

Figure 1. Wildlife camera photographs of individuals actively preying upon artificial wild turkey nests at the Radford Army Ammunition Plant, New River Unit (Pulaski Co., Virginia) in March-April 2017: (A) eastern fox squirrel, (B) American crow, (C) coyote, and (D) raccoon.



(grayscale version)