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Perch-type Characteristics of Overwintering Red-tailed Hawks (*Buteo jamaicensis*) and American Kestrels (*Falco sparverius*)

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Running Title: Perch-type Characteristics of Overwintering Red-tailed Hawks and American Kestrels

Abstract

Red-tailed Hawks (*Buteo jamaicensis*) and American Kestrels (*Falco sparverius*) are primarily sit-and-wait predators that rely on perches to forage most efficiently. Overwintering Red-tailed Hawks and American Kestrels use available perches (e.g., utility poles and wires, trees, fences, gates, etc.) to hunt for prey items in agricultural fields in northeast Arkansas. Observations were made from December 2011-March 2012 and November 2012-March 2013 in three representative cover-types (short rice stubble, soybean stubble, and fallow areas including roadsides) to determine which perch-types were used by Red-tailed Hawks and American Kestrels. Utility pole crossbeams at an average height of 6.3 m were the main perch-types used by Red-tailed Hawks, demonstrating the use of man-made structures'. These perches were generally in or near fallow areas or short rice stubble fields. Conversely, American Kestrels usually perched on wires at an average height of 4.9 m, over fallow roadsides'. Fallow areas had high prey density and vegetation cover. Niche separation via differential use of perches may be one factor that allows these raptors to avoid inter-specific competition.

Introduction

Red-tailed Hawks (*Buteo jamaicensis*; RTHA) and American Kestrels (*Falco sparverius;* AMKE) are both "sit-and-wait" predators that require the availability of perches (e.g., utility poles and wires, fences, posts, trees, etc.) from which to forage most efficiently. RTHAs and AMKEs have been documented to have a large overlap in wintering habitat (Pandolfino et. al. 2011). Both have been observed using the same habitats to hunt small mammals and using similar perch-types during the winter. Ecologically similar species that share the same habitat are predicted to decrease competition by partitioning resources for which they compete (MacArthur 1958). Accordingly, we studied which perch-types overwintering RTHAs and AMKEs used in northeastern Arkansas. We hypothesized that RTHAs and AMKEs will use different perch-types as one means to avoid direct competition with each other.

Study Area and Methods

The study was conducted in the southern portion of Craighead and the northern portion of Poinsett Counties, AR, between highways US-49 and AR-1. The study area has been heavily converted into agricultural fields, with rice and soybeans being the primary crops. Sparse woodlots and intersecting gravel roads are also present. During the fall, most fields are harvested, generally resulting in stubble, or short vegetation. We selected three cover-types that were predominantly found in the study area during winter, which were, short rice stubble (SRS), soybean stubble (SOY), and fallow areas and roadsides (FAL).

Observations were conducted on RTHAs and AMKEs from December 2011-March 2012 through October 2012-March 2013. Behavioral observations were recorded as soon as a perched RTHA or AMKE was found from a vehicle. We positioned ourselves at least 100 m away to avoid influencing or disturbing the bird and used 10 x binoculars and/or a 20-60 x spotting scope. We recorded perch characteristics including perch type, height, and cover-type with respect to perches. Data were also collected on number of attempts at prey and if attempts were successful. The time of each attempt was noted. Location of each bird was logged using a Global Positioning System to avoid possibly watching the same bird again. Observations continued until the bird left for a new habitat.

In order to determine which cover-types supported the highest prey biomass, we used estimations obtained from live-trapping, mark recapture-techniques, and Jolly-Seber analyses (Bobowski *unpublished data* Vegetation densities were determined using a modified version of Nudds' (1977) vegetation profile cover

board in several fields for each of our cover-types, and where reported as high, medium, or low (Bobowski *unpublished data*).

All data were analyzed using the statistical software program R (R Core Team and R Foundation for Statistical Computing 2012). To investigate relationships between the two species with regard to perch-type, attempts and success, we ran the Pearson's χ^2 test for independence. Since more than one perch-type could be utilized by a bird within one cover-type (e.g., utility poles with wires in between), we occasionally classified one bird utilizing more than one perch-type in a single observation. Conversely, one perch could be within two cover-types (e.g., a utility pole adjacent to a rice field and a fallow roadside), requiring us to record two cover-types for one bird.

Results

Over the two seasons we observed a total of 89 RTHAs and 64 AMKEs. Red-tailed Hawks were observed using the top of utility poles, crossbeams on utility poles, utility wires, trees, beams of gates, and agricultural equipment as perches while AMKEs were found only using utility poles, crossbeams, and wires. We excluded the RTHAs that perched on gates and agricultural equipment due to few occurrences (n = 2 and n = 1, respectively). We combined utility poles and crossbeams (referred to as "pole" from here on). The Pearson's χ^2 test for independence showed that the number of RTHAs and AMKEs significantly differed among the three perch-types. Red-tailed Hawks used poles 71.13% of the time, trees 27.84%, and wires 6.18% of the time (N=93, χ^2 =131.1, df=2, $p < 0.001$, Table 1). We determined that American Kestrels perch on utility wires 93.67% of the time and poles 6.33% of the time (N=79, χ^2 =131.1, df=2, $p < 0.001$, Table 1). Pearson's χ-square test for independence revealed that the number of RTHAs and AMKEs showed significant heterogeneity among attempts made from each of the three perch-types. American Kestrels used utility wires exclusively for foraging attempts at 93.67% and pole at 6.33% (N=262, χ^2 =264.5, df=2, $p < 0.001$, Table 2.). Red-tailed Hawks attempted to capture prey from pole perches the most often at 71.13% of all attempts, trees 20.62%, and wires 8.25% attempts (N=97, χ^2 =264.5, df=2, $p < 0.001$, Table 2). Furthermore, we determined that there was a difference in the number of RTHAs and AMKEs that made successful attempts from each perch-type. Red-tailed Hawks made 60% successful attempts from poles and 40% from trees (N=20, χ^2 =48, df=2, $p < 0.001$, Table 3). American Kestrels made all successful attempts from wires (N=28, χ^2 =48, df=2, $p < 0.001$, Table 3). We also determined that there is no significance in the number of RTHAs and AMKEs attempts in each of the cover types (χ^2 =0.1583, df=2, p =0.924).

Perch heights were averaged for each species and the average height for RTHA was 6.3 m, while the average height for AMKE was 4.9 m. Mammal densities were reported as high, medium, or low. According to Bobowski (*unpublished data*), FAL had the highest vegetation and prey densities, SRS and SOY were both low in vegetation and prey densities, this information is summarized in Table 4.

Table 1. Red-tailed Hawk and American Kestrel perch numbers by perch-type used; data were gathered from two winters 2011-2013 in northeast Arkansas.

	Total Perch-type Utilization		
	Wire	Crossbeam/Pole	Tree
RTHA	6	60	27
AMKE	74	5	0

Table 2. Red-tailed Hawk and American Kestrel prey attempts by perch-types; data obtained from two winters 2011-2013 in northeast Arkansas.

	Total Attempts/Perch-type		
	Wire	Crossbeam/Pole	Tree
RTHA	8	69	20
AMKE	246	12	0

Table 3. Successful attempts at prey from each perch-type by Red-tailed Hawks and American Kestrels during a two winter study from 2011-2013 in northeast Arkansas.

	Total Successful Attempts/Perch-type		
	Wire	Crossbeam/Pole	Tree
RTHA	0	12	8
AMKE	28	0	0

Table 4. Vegetation and Small mammal densities by cover-type in northeast Arkansas.

	Cover Types					
	SRS		SOY		FAL	
	Veg. Den.	Mammal Den.	Veg. Den.	Mammal Den.	Veg. Den.	Mammal Den.
RTHA	Low	Low	Low	Low	High	High
AMKE	Low	Low	Low	Low	High	High

Discussion

Since MacArthur's (1958) classic study on warblers, many recent examples of niche separation have been documented. For example, two grassland raptors, Swainson's Hawk (*Buteo swainsoni*) and Ferruginous Hawk (*B. regalis*), used prey partitioning to avoid competition (Giovannith 2005). In northeast Arkansas (present study) RTHAs and AMKEs overlapped in habitat use and the use of similar perch-types. However, AMKEs used wires for foraging perches 94% of the time, while RTHAs used wires less than 7% of the time. Utility poles used by RTHAs, were adjacent to wires 71% of the time. Results suggest that they exhibit separation in regards to the characteristics of perches from which they forage. The feet size and body size may lead to the use of different perches. RTHAs are larger birds which may make it difficult to balance while foraging from a wire, and will use poles as a more stable perch from which to forage. AMKEs may find wires a more suitable perch with their smaller feet (Bildstein 1987). These two species often show diet partitioning, but during the winter the normal prey for AMKEs; insects and amphibians are sparse and thus they may rely more on small mammals, which is also main prey for RTHAs. We found that AMKEs and RTHAs both made most attempts in FAL, and similar low amount of attempts in the other two cover-types (Table 4). Differential use of perch-types likely lowers direct inter-specific competition between these predator species.

Our findings of an average perch height for RTHAs at 6.3 m are lower than previous findings of an average height at 11.0 m, and 12.3 m perch height (Bildstein 1987, Leyhe and Ritchison 2004) respectively. However, these studies involved perches that consisted predominantly of trees where RTHAs in our study used primarily poles. Schnell (1968) found that RTHAs in Illinois used trees 77% of the time and 61.9% of those tree perches were of heights of ≥ 13.6 m. We may have observed RTHAs primarily perching on poles, due to their abundant availability in contrast to the limited number of available trees near fields.

We observed both AMKEs and RTHAs using utility wires and poles frequently as foraging perches, which demonstrates these raptors reliance on man-made structures while foraging. Our results are consistent with others that report that AMKEs predominantly use utility wires (Ferguson 2004, Craig 1978, Bildstein 1987). The average perch for AMKEs in northeast Arkansas was 4.95 m, which is much lower than other studies (e.g., Bildstein 1987).

Most prey attempts were in FAL, which also had high prey biomass. Preston 1990 reported that higher vegetation density supported higher prey biomass in a study on Red-tailed Hawks and Northern Harriers (*Circus cyaneus*) in central Arkansas, but this study did not report perch-type characteristics. Leyhe and Ritchinson (2004) study in central Kentucky looked at vegetation density and found that RTHAs foraged in low vegetation cover. Even though studies have found that both species forage in areas characterized as having both low vegetation and low mammal densities; we show that FAL is still used extensively compared to the other cover-types.

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