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Frequency of Injuries in Three Raptor Species Wintering in Northeastern Arkansas

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ABSTRACT.—It may be reasonable to assume that raptors would likely perish as the result of an injury that potentially impaired their ability to capture prey. We present results from 98 wild-caught raptors that support the converse claim: raptors can and do survive with many types of injuries. We report a conservative injury estimate of 14% for wintering populations of Red-tailed Hawks (*Buteo jamaicensis*), American Kestrels (*Falco sparverius*), and Cooper's Hawks (*Accipiter cooperii*) in northeastern Arkansas. Injuries in these species included broken or missing talons, ulcerative pododermatitis (bumblefoot), missing toes, healed wing fractures, and iris damage. *Received 11 October 2005. Accepted 29 July 2006.*

Raptors almost solely rely on live captures of potentially harmful prey (Gibson et al. 1998) and it seems reasonable to assume that a serious injury to an appendage or organ (e.g., eye) necessary for the successful capture of prey would ultimately result in the death of that individual (Cooper et al. 1980). There is often a need to rehabilitate injured birds because of injuries, both naturally and human inflicted (Ress and Guyer 2004). However, there is some evidence that birds with injuries can survive in the wild without rehabilitation (Blodget et al. 1990, Houston 1993, Murza et al. 2000, Roth et al. 2002, Tingay et al. 2004).

The frequency of injuries in raptors has been documented for Griffon Vultures (*Gyps fulvus*) (Houston 1993), North American accipiters (Roth et al. 2002), and American Kestrels (*Falco sparverius*) (Murza et al. 2000). The studies of vultures and accipiters quantified only healed fractures in the long bones and pectoral girdle, respectively. Murza et al. (2000) found an injury rate of 5.9% for wild-caught individuals in a Canadian population of American Kestrels. We present the occurrence of injuries in 98 wild-caught, wintering raptors in the delta region of Arkansas.

METHODS

Our study area included Craighead and Poinsett counties (35° 30′ 36″ N, 90° 36′ 91″ W) in northeastern Arkansas. The region is dominated by intensive agriculture, with interspersed small woodlots (typically <2 km^2). Major prey items for Red-tailed Hawks (*Buteo jamaicensis*) in the area included hispid cotton rats (*Sigmodon hispidus*) and marsh rice rats (*Oryzomys palustris*; BEB and AMS, pers. obs.). American Kestrels in the study area fed mainly on mice (*Peromyscus* spp.) and vole species (J. M. Learned, Arkansas State University, pers. comm.). The major prey species of Cooper's Hawks (*Accipiter cooperii*) are unknown, but assumed to be mainly Red-winged Blackbirds (*Aeglaius phoeniceus*) and other wintering songbirds.

We trapped, banded, and performed visual examinations of raptors during fall and winter 2002–03 and 2003–04. Raptors targeted for trapping and banding included Red-tailed Hawks, American Kestrels, and Cooper's Hawks for a concurrent winter ecology study. We trapped birds using (1) *bal-chatri* traps (Berger and Mueller 1959) using mammalian and avian baits, (2) bow-net traps and noose-harnesses baited with live Rock Pigeons (*Columba livia*) and European Starlings (*Sturnus vulgaris*), and (3) *dho-gaza* nets with a Great Horned Owl (*Bubo virginianus*) decoy (Jacobs 1996, Jacobs and Proudfoot 2002).

We estimated a keel/pectoral muscle mass index for a relative body condition index for each bird captured. The index was scored as (1) in superior condition if the keel felt indistinct between the pectoral muscles, (2) in average condition if the keel was noticeable, and (3) below average condition if the keel was distinct. We assigned ages to each bird as hatch-year or after-hatch-year based on plumage.

We used two-sample *t*-tests to test for dif-

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ferences in keel indices of injured and non-injured Red-tailed Hawks. We also created a body condition index using the residuals of a linear regression of tarsus length and mass (Webb et al. 2004). The regression of a structural body component and mass gave us an index of how much a hawk of a given size should weigh. If a bird had a negative residual from the tarsus length versus mass regression, it was considered to be in below-average condition. Conversely, if the residual was above the regression line (positive), the bird was considered in above-average condition. We used *t*-tests to compare residual condition indices of injured and non-injured Red-tailed Hawks.

We designated birds as injured if they had broken or missing talons, missing toes, healed fractures, or eye injuries. All of these conditions were considered injuries because of the potential vulnerability of hawks to attacks by prey, or if the condition could result in decreased hunting success. We did not perform complete physical examinations of all birds captured, nor did we use radiographs to examine for healed bone fractures. All injuries reported were opportunistically detected during routine banding and measuring processes; less obvious injuries were most likely overlooked. Thus, the injury estimates reported here are minimum values.

RESULTS

We trapped 98 raptors over the 2-year study period. We do not know if birds trapped were migrants or residents. Most birds captured were Red-tailed Hawks ($n = 86$, 43 juveniles and 43 after-hatch-year birds). We also captured seven American Kestrels and five Cooper's Hawks.

Fourteen percent of the raptors had injuries (Red-tailed Hawks—9%, kestrels—14%, and Cooper's Hawks—20%). We primarily focused on Red-tailed Hawk injuries because of the limited sample sizes for kestrels and Cooper's Hawks. We documented that 12% and 7% of captured juvenile and adult Red-tailed Hawks, respectively had injuries.

The keel indices of non-injured and injured Red-tailed Hawks did not differ ($P = 0.18$). We found no differences ($P = 1.0$) between body condition indices of the two groups (injured vs. non-injured) using the residuals of a mass versus tarsus length regression. Of the eight Red-tailed Hawks with injuries, six injuries were on the foot or leg and two occurred on the wing (one injured bird was re-captured with a different injury than during its first capture) (Table 1). There were two cases of ulcerative pododermatitis (i.e., bumblefoot), and both birds were classified as having Type II, characterized by the pronounced swelling on the affected foot. We captured one American Kestrel missing a leg and a digit on the remaining foot, and one Cooper's Hawk with a damaged iris sphincter (Table 1). All birds appeared to have incurred injury prior to trapping.

TABLE 1. Injuries observed (*n*) in wild-caught raptors in Arkansas during winters 2002–03 and 2003–04.

	Red-tailed Hawk	American Kestrel	Cooper's Hawk
Bumblefoot	2	[a]	[a]
Missing toe/leg	2[b]	1[c]	[a]
Broken talon	2	[a]	[a]
Healed wing fracture	2	[a]	[a]
Eye injury	[a]	[a]	1
Total captured	86	7	5

[a] Not observed.
[b] One bird was initially captured with a broken right #2 talon and was later recaptured (within the same year) with the right #2 toe missing. This bird is reported in both categories.
[c] This individual was missing its entire left leg and the #2 toe on its right leg.

DISCUSSION

We are not certain of the causes of injury for any of the birds captured. It is possible the injuries were caused by leg-hold traps set on poles for raptors (Durham 1981) or by other negative human interactions. It is also possible that some or all of the birds may have incurred injury during prey captures; some injuries may have been inadvertently self-afflicted. Our data suggest that injuries occur relatively frequently in wild raptors, irrespective of age. Injury rates have not been reported in previously studied populations of Red-tailed Hawks because most studies focus on breeding populations.

Our estimate of injured Red-tailed Hawks (9%) may be biased for two reasons. First, injured birds may be more prone to responding to a trap set, because of decreased hunting capabilities. We believe that our estimates are not biased due to decreased hunting abilities because if the injury caused a decrease in for-

aging success, the birds would exhibit below average body condition indices. The birds may have initially had decreased success following injury but all of the injuries observed were older and the birds were not in below-average condition. Second, we may have underestimated the frequency of injuries because we did not perform complete physical examinations on each individual after capture to feel for past breaks, skin lesions, or other inconspicuous injuries.

Documented injury percentages range from 6 to 20% for raptor and vulture species (Houston 1993, Murza et al. 2000, Roth et al. 2002, this study). Houston (1993) found the highest incidence of injuries in vultures (20%) by examining for healed fractures, and attributed the high frequency to the fragile bone structure needed for low wing loading. Fractures of the pectoral girdles (18.6%) in Cooper's Hawks may be due to impacts while attempting to secure prey (Roth et al. 2002). Murza et al. (2000) found a lower injury incidence in American Kestrels (6%), which might be explained by the hunting strategy of kestrels. Kestrels do not use their talons to kill prey as do other raptors, but merely as extensions of their toes to hold prey and quickly damage the spinal cord with their bill (Csermely et al. 1998). We surmise the risk of the Red-tailed Hawk's foraging strategy lies between that of Cooper's Hawks and kestrels, and the frequency of injury (9%) is between the previous estimates documented for those species. Red-tailed Hawks hunt in relatively open areas which decreases the risk of impacts and fractures, but their prey is often larger and stronger than that taken by kestrels.

Our data suggest the frequency of injuries in raptorial species is relatively high. A more in depth examination of birds trapped in wintering areas may provide more data regarding healed fractures and previous injuries. Many injuries incurred by raptors may ultimately result in death (e.g., eye lesions or hallux injuries), but our data suggest that many external injuries are not as detrimental as might be expected.

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