Disappearance of Raptor Carcasses in an Urban Environment

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Introduction

Mortality is one of the most important aspects underlying population dynamics (Ricklefs 2000), and understanding mortality often hinges on finding carcasses and using necropsies to diagnose the cause of death. When carcasses go unnoticed or unreported, counts and causes of mortality may be underestimated or skewed. Scavenging by terrestrial vertebrates has been implicated as a major reason carcasses disappear in exurban environments (Devault et al. 2004, Kostecke et al. 2001). Because causes of mortality often differ markedly in different environments (DeVault et al. 2003), we wondered if the composition and efficacy of the scavenging community might also differ. As part of a larger study investigating the electrocution of urban Harris's hawks *(Parabuteo unicinctus)* on overhead power distribution systems, this study was conducted to evaluate the persistence of carcasses of birds of prey (raptors) in an urban landscape, and to evaluate how carcasses disappeared.

Study Area

Our study was conducted in Tucson, Arizona, and was broadly defined those portions of metropolitan Tucson provided with electric service by the Tucson Electric Power Company. The Tucson metro area includes a population of about 900,000 people (Pima association of governments 2004), is located in the Sonoran Desert, and supports Lower and Upper Sonoran vegetation types (Brown et al. 1979). Although remnants of these vegetative communities persist, much of the natural vegetation has been removed or replaced with exotic plants, and rivers and drainage courses are dry most of the year. Tucson supports a diverse assemblage of raptors during both the breeding season and through the winter, including Harris's hawks *(Parabuteo unicinctus)*, red-tailed hawks *(Buteo jamaicensis)*, great-horned owls *(Bubo virginianus)*, and Cooper's hawks *(Accipiter cooperii)* (Mannan et al. 2000), as well as a broad guild of potential scavengers including coyote *(Canis latrans)*, domestic dog *(Canis familiaris)*, skunk *(Mephitis mephitis* and *Mephitis macroura)*, and bobcat *(Lynx rufus)*, common raven *(Corvus corax)*, and turkey vulture *(Cathartes aura)*.

Methods

We delivered letters to all properties within 300 meters of Harris's hawk nests in our study area to inform residents that there was a Harris's hawk nest in the area, and to request that we be contacted in the event that a dead or injured raptor was discovered. Eight weeks after the young from a given nest had fledged, we placed the carcass of a raptor at the base of the nearest "safe" power pole to the nest. Raptor carcasses were donated by wildlife rehabilitators only after efforts to treat these bird's critical injuries had failed. In an effort to mimic as closely as possible the relatively large carcasses of Harris' hawks around whose nests we worked, we limited experimental carcasses to Harris' hawks, red-tailed hawks, Coopers' hawks (female only) *(Accipiter cooperii)*, and great-horned owls. Safe poles were defined as poles where all exposed, differentially energized conductors where separated by at least 61 cm. This selection criterion facilitated minimizing the possibility that avian scavengers would be electrocuted as a result of our study, while simultaneously allowing us to mimic and observe the location of typical mortalities in a way few previous studies have done (DeVault et al. 2003).

We placed the fresh carcasses of 23 raptors near nests at distances ranging from 7 to 220 m. We then visited carcasses daily for one week, and every other day for another week, to determine whether the carcass had been moved or removed and to try to decipher what may have moved it. We also responded to calls when residents reported carcasses by explaining this portion of the project to the resident (it was not mentioned in our letter), and collecting the carcass. To minimize human scent at carcasses and any attention our observations might attract, we observed carcasses through binoculars from >15 m during routine checks, and only approached more closely if a carcass appeared to have been moved or disappeared. On each visit, carcasses were recorded as unmoved, moved but within 7.6 meters of the base of the pole, or moved beyond 7.6 m (disappeared). We classified carcasses as within or beyond 7.6 m from the base of the pole because avian electrocution fatalities are typically sought within this distance (e.g. Harness 1999). We searched a radius of 25 m from the base of the pole for missing carcasses to try to determine what may have removed them.

Results

Of our 23 experimental carcasses, 26% disappeared within 1 day, 35% disappeared within 3.5 days, 39% were gone in 1 week, and 43% were gone in 2 weeks (Figure 1, Table 1). An additional 22% of carcasses were reported by residents within 1 day, and 30% were reported within 3.5 days. No reported carcasses showed evidence of having been scavenged by wildlife prior to being collected, and only one carcass was definitively removed by wildlife. The remains of this carcass were found scattered 7-15 m away. Three carcasses were found >7.6 m from the base of the pole where I had left them, and were classed as "removed." Each of these was removed by humans: one was buried, with a makeshift cross placed above the grave, one was placed in a trash can, and one was apparently thrown over a fence and adjacent hedge into a vacant lot. Overall, 43% of carcasses were encountered by residents and either removed or reported prior to being consumed by scavengers, while only 4% of carcasses were encountered by scavengers and consumed prior to being removed by humans. Another 26% of carcasses were never reported, removed, or consumed, and the mechanism of removal of the remaining 27% could not be determined.

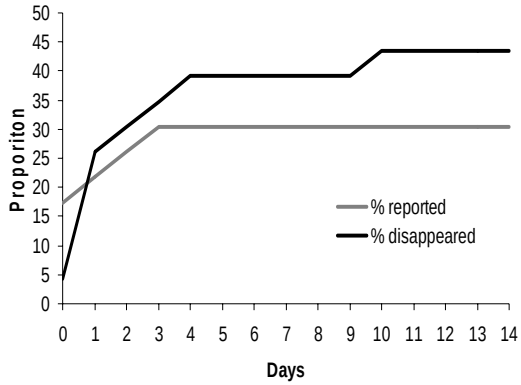

Figure 1. Proportion of carcasses removed

Table 1. Summary of experimentally placed carcass data collected in Tucson, Arizona, USA, from September 2, 2003 through August 16, 2004 (distance reported in meters).

Placement Date	Disappeared on day #	Removed by	Distance from nest	Direction from nest	Carcass Species
6/28/2004	0	undetermined	45	S	RTHA
6/17/2004	0	me - reported	100	NE	RTHA
6/28/2004	0	me - reported	60	N	COHA
7/2/2004	0	me - reported	160	S	GHOW
7/19/2004	0	me - reported	60	SE	COHA
8/4/2004	1	undetermined	45	NW	COHA
8/16/2004	1	undetermined	140	S	COHA
7/2/2004	1	undetermined	100	SE	COHA
9/2/2003	1	human	30	SW	GHOW
1/3/2004	1	human	130	NW	RTHA
7/5/2004	1	me - reported	7	S	GHOW
7/14/2004	2	undetermined	95	N	COHA
7/19/2004	2	me – reported	65	N	RTHA
6/7/2004	3	undetermined	220	N	COHA
7/14/2004	3	me – reported	105	E	RTHA
7/19/2004	4	wildlife	205	S	RTHA
1/4/2004	10	human	85	NW	HRSH
9/4/2003	never	N/A	20	SW	COHA
5/31/2004	never	N/A	40	E	GHOW
6/11/2004	never	N/A	120	W	GHOW
6/11/2004	never	N/A	205	E	COHA
7/12/2004	never	N/A	25	S	GHOW
8/4/2004	never	N/A	35	S	RTHA

Discussion and Conclusions

Exurban studies of terrestrial scavenging demonstrate non-human terrestrial vertebrates to be the primary scavengers, with about 75% of carcasses disappearing in 22 studies (DeVault 2003, Devault et al. 2004). The proportion of carcasses scavenged is similar here, but we found that humans were the primary species to encounter and remove carcasses in our urban study area. If we assume that the carcasses reported by residents would have been disposed of by those residents if they had not known to call us, we find that 74% of carcasses would have disappeared within 3.5 days. Human residents expressed surprise at our interest in carcasses, and many relayed that they had previously encountered raptor carcasses and had disposed of them as garbage. Because we notified residents of our study, the rate of reporting described herein is expected to be high, reflecting a best-case scenario of public input. We suggest that researchers of urban wildlife design their projects to avail themselves of the public's willingness to contribute to conservation studies.

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Figure 2. A great horned owl carcass experimentally placed near a Harris's hawk nest to evaluate the response of human residents.