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Greater Kestrel survives impact with power lines

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Thousands of birds are killed by power lines worldwide each year (Bevanger 1998, Lehman et al. 2007) either by electrocution or by direct collision. According to recent research from South Africa, Blue Cranes *Anthropoides paradiseus* and Denham's Bustards *Neotis denhami* and other large or fast-flying species are those most often found below power lines in open habitat across the Karoo and Overberg regions of South Africa (Anderson 2002, Shaw 2009, Jenkins et al. 2010). Mortality rates from collisions in South Africa number 0.31~3 cranes and bustards per kilometre of power line per year depending on the region and suggest unsustainable levels of mortality may be reducing populations of these species (Jenkins et al. 2010, Shaw et al. 2010). While these and other studies (Janss 2000) suggest a higher risk of mortality to power lines by large birds, this may be biased because smaller species are overlooked or last a shorter time before being scavenged, particularly in African landscapes (Jenkins et al. 2010). A mortality register of all large and small power lines in South Africa suggest most individuals die from direct impacts (271 birds y^{-1}) rather than electrocution (122 birds y^{-1}; van Rooyen and Ledger 1999), and do so by striking the narrow 'earth-wire' set above the heavier transmission lines (Alonso and Alonso 1999, Jenkins and Smallie 2009). Many other species, particularly raptors (Falconiformes), die from electrocutions (Markus 1972, Ledger and Annegarn 1981, Mundy et al. 1992, Ferrer and Janss 1999, Mojica et al. 2009), but direct observations are rare. Electrocutions are seemingly higher in this group (particularly the larger species) because they live around the pylons supporting the power lines, using them as perch and nesting sites (Ledger and Annegran 1981, Ferrer and Janss 1999, van Rooyen 2000, Machange et al. 2003), and thus spend large proportions of their lives around potentially dangerous conductors.

However, given the amount of time that raptors spend chasing prey or displaying around such lines their mortality rates appear relatively low (or under-recorded) and one presumes some sort of learning and avoidance, at least of collision with the transmission lines, is evident. Direct observations of wild birds impacting lines are very rare, however (Alonso and Alonso 1999, Mojica et al. 2009), and allow little insight into how and why they occur.

Here I describe the circumstances in which a Greater Kestrel *Falco rupicoloides* struck a power line and apparently survived. During field work in the Succulent Karoo biome, 15 km north of Vanrhynsdorp, South Africa (31°26.9′ S, 18°41.0′ E), on 25 August 2006, my attention was drawn to calling Greater Kestrels flying below clusters of 400 kV transmission lines. One bird, the presumed male, was courtship-chasing a second bird, presumed female, and performing the fluttering display flight, characterised by shallow rapid wing beats (Jenkins 2005). As the male followed the female, with one or both birds calling, he flew horizontally and slightly upwards towards the lowest pair of transmission lines, apparently unaware of their presence and hit one or both paired conductors with his back. The impact was not hard but it caused him to immediately drop about 3 m, after which he fluttered earthwards for about 15 m where he landed after about 10–15 s. I followed his progress from about 200 m and after a short interval he flew unsteadily up from the ground, but was subsequently lost. While dropping following the initial 3 m he hovered rapidly earthwards, suggesting that he had not been electrocuted and was not unconscious and in free fall. I made my way directly to the site, just beyond the lowest point of the catena, and searched an area of c. 100 m (parallel with the line) and c. 30 m (either side of the line) in the open quartz ground and low succulent bush for about 10 min. I found no feathers or carcass and concluded that the kestrel had recovered and flown off. That it had apparently survived the impact was partly expected given the glancing blow and apparent consciousness of the bird following impact. He had also not earthed any conductor, so electrocution was also avoided.

Several pairs of Greater Kestrels were breeding about 12 m up on the pylons, so this particular impact was probably by a resident bird, suggesting that even birds that live in and around the pylons are susceptible to impacts with the transmission line.

More importantly, it illustrates that when birds are engaged in intense behavioural interactions they seem less aware of obstacles around them. It is obvious that kestrels have not evolved with narrow wires in their aerial environment and only learned behaviour is likely to equip them with knowledge to avoid such obstacles. That Greater Kestrels are relatively successful at doing so is borne out by observations from a long-term study of this species nesting on power lines at Rhenosterfontein near Pretoria, South Africa, where no such collisions were observed in over 15 years and thousands of hours of observations (A Kemp *in litt*.), nor in studies in the former Transvaal (W Tarboton *in litt.*). Only four dead or damaged birds were found below the Rhenosterfontein pylons or power lines, one of which

was a metal-ringed fledgling that may have suffered electrocution or a lightning strike (Kemp 1984). The only collision witnessed was by a juvenile Lanner Falcon *Falco biarmicus* flying ahead of an approaching storm that collided with a pylon and broke a wing and died (Kemp 1993). This indicates that collisions are indeed overlooked but that they happen at a very low frequency.

That other raptors are killed when they are engaged in other activities is borne out by two other observations of raptor mortality on impacting transmission lines. In the first, two Australian Brown Falcons *Falco berigora* were observed fighting in midair and made contact and cartwheeled earthwards locked together. On their way down they hit power lines, decapitating one of them and severely injuring the second (N Mooney in Simmons and Mendelsohn 1993). In the second example, an adult male Martial Eagle *Polemaetus bellicosus* was electrocuted as it grasped the claws and feet of an immature female Martial Eagle. They were found dead below a pylon, exhibiting no external signs of injury, having presumably touched and earthed the high voltage lines on the way down (Simmons et al. 2004).

These falcon and eagle examples suggest that among species that live in and around pylons, intense behavioural interactions can lead to impacts; in these cases, territoriality or courtship, not size and agility were mitigating factors in their impact or death. That impacts may be under-recorded in smaller raptors such as Peregrines *Falco peregrinus* is suggested by their low reporting rate below power lines but high incidence of traumatic death. For example, clinical examination of 3 376 Peregrines in Saudi Arabia indicated traumatic injuries (i.e. impacts with buildings rather than disease) ranked second among all types of mortality (Naldo and Samour 2004). In urban South Africa, a higher proportion of traumatic injury is apparent among African Peregrines where an estimated 60–70% of all deaths are caused by impacts with power lines in a 21-year study (AR Jenkins unpublished data). Thus small, highly aerial, raptor species may be equally likely to die from impacts during intense behavioural interactions or chases as are large, less manoeuvrable species, but few are observed and fewer are recorded.

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