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The impact of electrocution on the New Zealand falcon (*Falco novaeseelandiae*)

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Abstract In a 5 year radiotracking study of 55 falcons on the Wairau Plain, Marlborough, the causes of death in 21 birds were identified. Of these, 10 (47%) falcons were electrocuted (7 juvenile females, 1 adult female, 1 juvenile male, and 1 adult male). Seven of the 10 poles were fitted with transformers. This level of mortality is thought to be too high to sustain a population of falcons. Suggestions are made how to mitigate the problem.

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INTRODUCTION

Wild birds have been electrocuted on installations in New Zealand for many years, but the impact of the problem has not yet been quantified. There is an extensive literature from other countries on levels of bird electrocution and on designs of electrical installations that can reduce the hazard (Ivanov & Sedunova 1993, Lehman *et al*. 2007). Power transmission lines *pro rata* cause far more deaths than wind turbines (Winkelman 1995). On the other hand, in countries where nest sites are limited, safe power pylons can provide suitable nest supports (Potapov *et al.* 2001).

When a bird is electrocuted, it may die immediately and fall to the ground, or it may die and become lodged on the pole. In the latter, the carcass may cause a power outage, and unless the line trips, the bird may continue to have current running through its body. The senior author has witnessed a peregrine (*Falco peregrinus)* lodged for 10 minutes, burning on the cross-pole, before falling to the ground in flames. Sometimes birds survive electrocution but suffer burnt feet or internal organ damage. On one occasion, 2 prairie falcons (*F. mexicanus*) were seen to be electrocuted and took 5 days to die.

Sometimes birds receive only a slight jolt during electrocution and recover. During 5 years at Wingspan, Rotorua, 2 trained falcons were electrocuted but recovered, and a further falcon, being rehabilitated by Dean Thomas at Wanaka, was electrocuted but recovered later (Noel Hyde, *pers. comm.*) The senior author has also witnessed trained northern goshawks (*Accipiter gentilis*) on 3 occasions falling to the ground but recovering after electrocution. In these cases the hawks had shorted the double lines slung between pylons, with electrical cross connections at 50 m intervals. Presumably, in such a scenario, there is only a small electrical differential between the 2 wires, which is insufficient to kill the bird.

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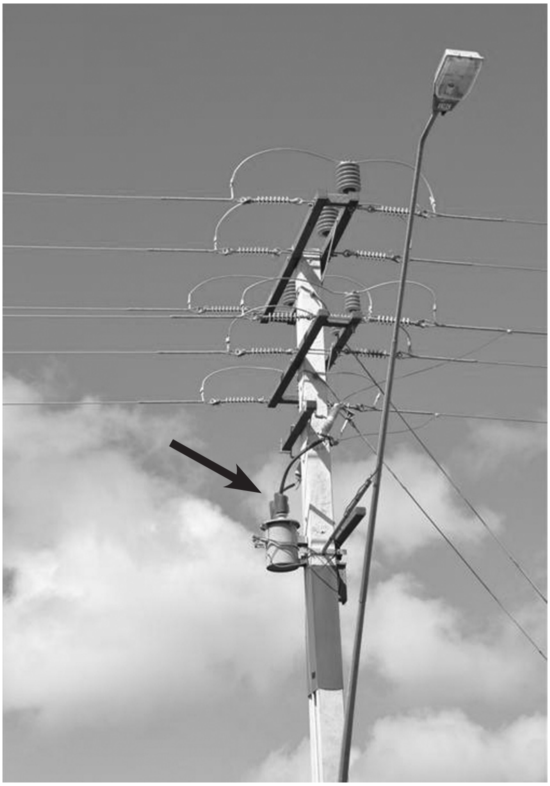

Fig. 1. Example of a electrical pole that electrocuted a juvenile male New Zealand falcon. The pole was later retrofitted with insulators (arrow) to prevent further electrocutions.

Assessing the levels of electrocution and their potential impact on populations of birds can be difficult. For example, it is unusual to directly witness the electrocution of wild birds. Even dead bodies below poles may be quickly scavenged and electrocutions are hard to quantify if some birds survive the initial contact with the power pole only to die later elsewhere (Ferrer & Janss 1999). Although the senior author has witnessed the death of 3 trained peregrines falcons and 2 prairie falcons through electrocution, and 1 peregrine killed by a wind turbine, such anecdotal observations cannot provide a robust estimate of the severity of the problem. In this study we present a quantitative estimate of electrocution rates in a population of radio-tracked New Zealand falcons.

METHODS

During an ongoing 5 year study of New Zealand falcons on the Wairau Plain in Marlborough we translocated young falcons from nearby wild nests into artificial nests so that they fledged into vineyard areas. Of these, 31 female and 22 male falcons were fitted with back-pack radio-transmitters that allowed us to follow the movement and fates of each bird. The radio-transmitters were fitted with 10 cm insulated aerials projecting from their backs. Although some of the original birds are still alive at 5 years old, most of their back-packs ceased to function after 9-24 months, and thus our chances of finding dead individuals were biased towards this period. As far as we are aware, no electrocutions involved the transmitters or affected them, but if transmitters had been blown, we would have been unlikely to find the bird. Because of this, and because falcons were impossible to track once their tags had expired, our results are likely an underestimate of the true rate of electrocution. For example, as well as the 21 dead individuals that we found, we had a further 8 falcons which were missing, presumed dead, but impossible to find.

When a dead falcon was located, we determined the causes of death as best we could from the field signs and from marks on the body. Where electrocution was implicated, we noted the identification number of the pole, its longitude and latitude, and photographed the pole.

RESULTS

Of the 21 radio-tagged falcons in our study known to have died, 10 (47%) birds were electrocuted. A further 9 falcons were killed by man-made hazards such as cats (*Felis silvestris*) (4 birds), road deaths (2 birds), shooting (2 birds), poison (1 bird), and unknown (1 bird). Only 1 (5%) falcon died a 'natural' death. This individual was killed by a swamp harrier (*Circus approximans*).

Of the 10 study falcons electrocuted, 7 birds were juvenile females, 1 was an adult female, 1 was a juvenile male, and 1 was an adult male falcon. An additional wild falcon electrocuted at Arthurs Pass (photographed by Graeme Kates) was an adult female and another wild falcon, found by Andrew Johns at Ngakuta Bay, Queen Charlotte Sound on 18 Feb 2010, was a juvenile female electrocuted on a transformer pole.

Thus 9 of the 12 poles associated with an electrocution involved transformers. As far as we know, no electrocuted falcons in our study survived.

DISCUSSION

Our observations indicate that electrocution may be the single greatest cause of mortality in the New Zealand falcon, at least in areas of their range with electrical grids. Almost half of the birds that we followed during a 5 year period died from electrocution. Combined with mortality from other man-made hazards (i.e., exotic predators, road collisions), almost no mortality was due to 'natural' causes.

The current designs of poles and in particular, transformers, can be lethal to perching birds large enough to short electricity from wire to cross-arm, or between wires or connections. Species large enough to be potentially affected in New Zealand include the New Zealand falcon, kea (*Nestor notabilis)*, New Zealand pigeon (*Hemiphaga novaeseelandiae)*, and Australasian Magpie (*Gymnorhina tibicen)*. Smaller passerines, such as starlings (*Sturnus vulgaris)*, tend to be too small to cause a short, but despite this, large numbers are also reported dead by power line workers who place spikes on the cross-arms to deter them. Other birds in this size range, such as blackbirds (*Turdus merula*) may also be killed (D. Lerwill, *pers comm*.) For the same reason, male New Zealand falcons, being smaller than females, may be less at risk.

In vineyard areas, trees and other perches tend to be cleared to minimise pest bird presence. Additional power poles are erected to supply pumps and wind machines. These poles are attractive perches for falcons and other birds, often being the only perches available. Thus, although falcons have been shown to reduce pest bird damage in vineyards (Saxton 2010), they themselves face increased risk from increased use of poles. Two falcons in our study were even shot by vineyard workers. As a result, we have discontinued building a falcon population on the Wairau Plain and have transferred operations to the lower Awatere where the density of power poles is less. We believe that in the Wairau Plain, which hosts an unknown number of wild falcons, especially in the autumn, electrocution is a limiting factor for colonisation. It is also a sink; depleting young falcons dispersing from nests in the nearby hills.

New Zealand is behind in the management of power poles and bird electrocution, both in practical terms and in its legal structure. As far as we can ascertain, power line companies do not require Resource Consent, nor are they required to make an Environmental Impact Assessment, nor to use designs that are wildlife friendly. Brian Tapp, Operations Manager for Marlborough Lines, told us that, provided that there is no power outage, Marlborough Lines is not concerned about bird deaths caused by its installations and does not consider it part of its responsibility.

It is not surprising therefore that there is an inverse correlation between the distribution of falcons and the distribution of humans in New Zealand (Fox 1978, Department of Conservation 2002). Faced with a high level of man-made mortality as we found in this study, it is possible that the New Zealand falcon is unable to sustain its

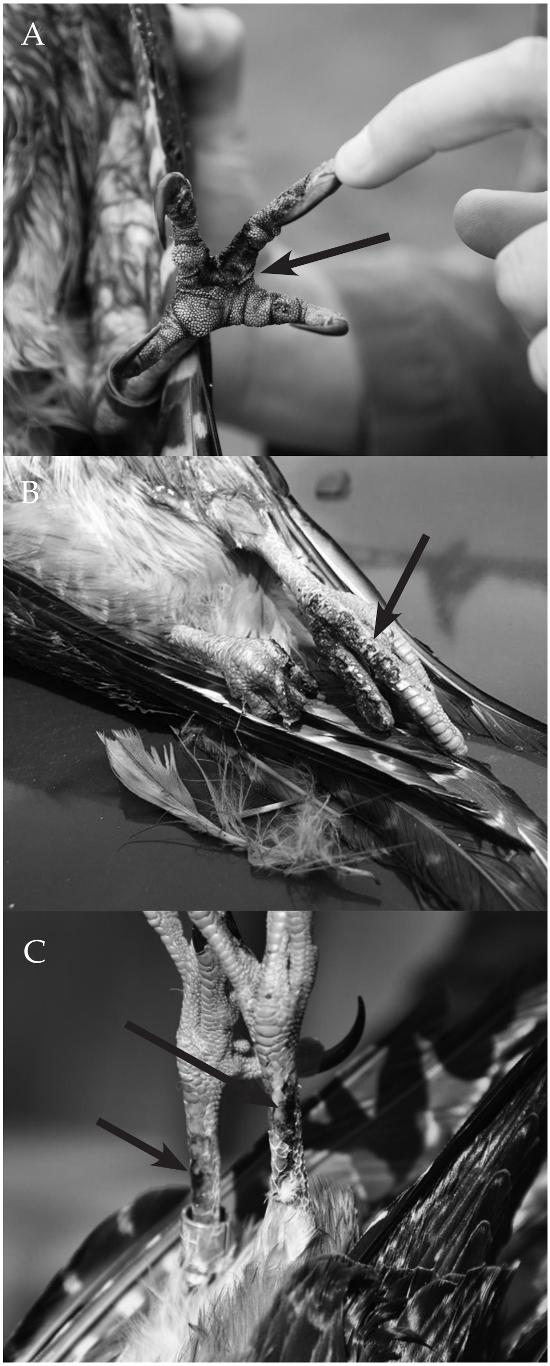

Fig. 2. Three examples of electrical burns in the New Zealand falcon as a result of collisions and contact with electrical poles. (A) Juvenile female falcon with burns to underside of foot. (B) Adult female falcon with burns to toes. (C) Adult male falcon with burns on both tarsi. All 3 birds died from electrocution. Arrows point to areas most affected by electrical burns. Photos by authors.

population in many man-managed environments. However, it is possible to reduce electrocution risk by the use of safe designs. This can be achieved either by retro-fitting insulation covers or sleeves, or by phasing in designs that intrinsically meet wildlife safety standards (which currently do not exist here). The fitting of spikes or insulating tape has limited benefit for raptors with wingspans that can span the distance from the wire to another wire or to a metal cross arm.

Experience in other countries has shown that voluntary agreements with power companies do not work (Lehman *et al.* 2007). What is needed is to examine technical standards already developed elsewhere and fine-tune them for New Zealand requirements. Those New Zealand Standards need then to be built into legislation and become part of the planning regulations and specifications for new structures. For further details on this see Haas *et al.* 2005.

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