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SHORT NOTE

Causes of mortality for kārearea / New Zealand falcon (*Falco novaeseelandiae*) in the Whakatipu district

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Kārearea, the New Zealand falcon (*Falco novaeseelandiae*), are the last vestige of a formally more diverse group of raptors endemic to New Zealand. Three other endemic raptor species have formerly succumbed to hunting pressure, loss of prey and introduced mammalian predators following human colonisation (Tennyson & Martinson 2006). As such, kārearea are of particular conservation interest.

Three morphometric forms of kārearea are recognised: the bush falcon, inhabiting the North island of New Zealand and the north and west South Island; the eastern falcon inhabiting the drylands of the eastern South Island; and the southern falcon, inhabiting Fiordland, Stewart Island, and the Auckland Islands (Heather & Robertson 2005). Recent genetic research, however, indicates that two subspecies divided by Cook Straight may be a more appropriate separation of the forms (Trewick & Olley 2016).

Previous research on causes of mortality for kārearea has identified anthropogenic hazards as a major source of mortality, with electrical utility structures of particular concern (Fox & Wynn 2010). Fox & Wynn (2010) monitored 55 translocated juvenile kārearea in Marlborough using radio telemetry over a 5-year period. Of the 21 mortality events where cause could be identified, only one died of 'natural' causes (killed by a harrier, *Circus approximans*). Ten were killed by electrocution, 4 by cats, 2 were killed on roads, 2 were shot and 1 was poisoned. Cause of death could not be ascertained for 1 individual (Fox & Wynn 2010).

The review of falcon mortality presented here was instigated following a perceived high rate of electrocution in the town of Glenorchy, which lies at the head of Lake Whakatipu in the South Island of New Zealand.

In total, 13 kārearea mortality events were documented, comprising 12 birds which were handed to DOC and a single eye-witness account over a 10-year period (Table 1). Most of these events (10) were from Glenorchy, and the remainder from elsewhere in the Whakatipu district. Cause of death could not be ascertained for 4 of the 12 specimens as none of the birds had any visible wounds or damage indicating predation, and little information was available regarding the circumstances around their discovery.

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Table 1. Date, age, sex and cause of death for 14 kārearea mortality events in the Whakatipu District

Date	Age	Sex	Cause of death	Notes
Unknown	Adult	Female	unknown	Deposited in DOC freezer with no notes.
March (year unknown)	Juvenilew	Female	Unknown	Found on public walking track in beech forest.
Unknown	unknown	unknown	Collision with wire deer fence	Collision resulted in broken wing, and death within a few minutes. Eye witness account.
April 2006	Juvenile	Female	Unknown	Found with broken wing, cause unknown. Euthanised.
July 2007	Adult	Female	Electrocution	Found under pole mounted transformer. Burns to talons.
April 2008	Adult	Female	Unknown	Found raiding a domestic cats bowl. Taken to veterinarian and died shortly after.
August 2010	Adult	Male	Electrocution	Found under pole mounted transformer.
July 2012	Adult	Female	Electrocution	Found under pole mounted transformer.
June 2013	Adult	Male	Electrocution	Found under pole mounted transformer.
May 2014	Adult	Female	Building window strike	
February 2016	Juvenile	Male	Building window strike	
March 2016	Juvenile	Unknown	Electrocution	Found under pole mounted transformer.
June 2016	Adult	unknown	Electrocution	Found under inline power pole, burns to talons, right metacarpal joint and breast.

Three kārearea were killed in collisions with human made objects. An eye-witness account by a Department of Conservation employee was received of a kārearea colliding with a wire deer fence. This bird broke one wing in the collision and died a few minutes afterwards. Two kārearea were killed in building window strikes, and 1 more (adult male) was brought to the author following a window strike. That bird was successfully rehabilitated and released (May 2016), though would have likely died had it not been taken into temporary captivity.

Electrocution was by far the most common cause of death, with 6 mortality events from electrocution on power installations. Most of these electrocution events (5) involved pole mounted transformers, while 1 occurred on an inline power pole. While Fox & Wynn (2010) found a strong sex bias towards females (8 out of 10 electrocution events), in the current study the sex ratio of the small sample where sex could be determined (n = 4) is an even split, with 2 males and 2 females (Table 1).

There was also a notable seasonal variation in mortality events. Of the 12 deaths with a date attributed, all but one occurred in the 6-month period from March to August, i.e. late summer to mid-winter. In addition, the rehabilitated bird window strike also occurred within this period (May).

While the dataset presented here is relatively small, it does provide information useful to wildlife managers and provides a valuable comparison to the data presented by Fox & Wynn (2010) collected in Marlborough. The high number of events recorded from Glenorchy is likely a combination of factors. First is the sheer number of falcon in the area. Whereas Fox (1978) reports territory spacings of 3.8 to 13.7 km, a previous survey in Glenorchy found 5 nest sites within a 7 km radius (Lawrence 2011). Second is the social dynamic in Glenorchy, a small town with a prominent DOC presence which, for the most part, enjoys a positive relationship with the community. This has likely led to a high rate of reporting on kārearea mortality events by the public.

Caution does need to be taken in comparing the results presented here with those of Fox & Wynn (2010), however, owing to the different methodologies used to collect the data. While Fox & Wynn (2010) followed 55 falcon using radio telemetry, inclusion of a mortality event in the data presented here was reliant on: a) the carcass being discovered; and b) either being handed in to DOC

or an eye-witness account being shared. This is less likely to occur for mortality events such as illegal shooting of falcon, or predation events that take place away from public view.

Despite these cautions, the data presented clearly demonstrate that electrocution of kārearea on power installations is more widespread than previously documented. The proportion of kārearea deaths attributed to electrocution here (54%) is remarkably similar to that reported from Marlborough by Fox & Wynn (2010; 47%). Despite the lower abundance of pole mounted transformers in the electrical infrastructure compared to inline power-poles, they account for the majority of kārearea electrocution events (5 out of 6). This finding is consistent with previously reported figures (Fox & Wynn, 2010; Kross 2014). While kārearea are not the only birds susceptible electrocution in New Zealand (Kross 2014), these results support the conclusion that kārearea are at far greater risk than other species.

The seasonal trend in mortality is difficult to explain given our limited understanding of kārearea habitat use and home range in the South Island high country. While a high rate of mortality for juveniles might be expected in the March to August period when they are dispersing from their natal territories, the majority of the mortality events involved adult birds (8 out of 12). It is possible that in the mountainous Whakatipu terrain, snow in the higher altitude areas necessitates kārearea moving into lower altitude hunting areas in winter, and hence lead to an elevated risk of exposure to anthropogenic hazards. In recent years there has been much research on kārearea habitat use in plantation forestry (e.g. Seaton *et al.* 2010; Thomas *et al.* 2010), but little in the South Island high country since the late 1970s (Fox 1977).

The findings from this survey reinforce the findings of Fox & Wynn (2010) that electrocution is a major source of mortality for kārearea, and highlights that it is a national rather than a localised issue. The lack of explanation for the seasonal trend in adult kārearea mortality, beyond conjecture, highlights our lack of understanding of kārearea habitat use in the South Island high country. Research efforts in both these areas, and action regarding the high rate of electrocution, is needed to guide conservation efforts of our last endemic raptor.

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