

SHORT NOTE

Frugivory and primary seed dispersal by a New Zealand falcon (*Falco novaeseelandiae*) at Red Tarns, Mt Sebastapol, New Zealand

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Raptors are primarily carnivorous but occasionally defecate seeds and therefore have the potential to act as seed dispersers. It is generally assumed that this is secondary dispersal rather than direct consumption of fruit by the raptor (Padilla & Nogales 2009). By depredating frugivorous animals such as birds and lizards, raptors can be important for seed dispersal and regeneration of plants through secondary dispersal mechanisms. Secondary seed dispersal is a multistep system that includes 2 or more dispersal processes, and can increase the distance that seeds are moved from the parent plant (Padilla & Nogales 2009). For example, on the Canary Is, seeds of *Rubia fruticosa* (Rubiaceae) are eaten by frugivorous lizards (primary dispersers) that are subsequently preyed upon by Eurasian kestrels (*Falco tinnunculus*), leading to secondary dispersal of seeds originally consumed by the lizards (Nogales *et al.* 2007). The Eurasian kestrel in this system is considered an important and effective long distance secondary seed disperser in 2 ways: 1) when it captures lizards and returns to the perch, the digestive tracts of the lizards are rejected with seeds intact; and 2) when lizard gut contents are occasionally ingested by the kestrel, some seeds are passed through intact (Nogales *et al.* 2007; Padilla & Nogales 2009).

Globally, only 13 species of birds of prey, in 3 families, have been recorded consuming fruits (Galetti & Guimarães Jr. 2004), including some records of kites (eg. *Elanoides forficatus*) that directly consumed small berries and seeds with fleshy arils. In Guatemala, female barred forest-falcons (*Micrastur ruficollis*) have been observed feeding on the small fruits of *Tikalía prisca* (Sapindaceae) that fall to the forest floor (Thorstrom 1996). In Brazil, the crested caracara (*Caracaras plancus*) is known to consume and disperse the large, lipid-rich fruit of the palm *Attalea phalerata* (Palmae), and such behaviour has led to the suggestion that raptors may consume lipid-rich fruit to balance a protein-rich diet based on animal prey (Galetti & Guimarães Jr. 2004), a phenomenon which is also found in carnivorous arthropods (Pizo & Oliveira 2001).

The New Zealand falcon (*Falco novaeseelandiae*) is known to prey on mostly small birds, rodents and insects, and sometimes on small mammals and lizards (Fox 1977; Marchant & Higgins 1993; Seaton *et al.* 2008). The only published records of New Zealand falcons taking fruit are from captive individuals which were observed eating peaches, apples and tomatoes (Fox 1977). New Zealand falcon pellets have occasionally been found with seeds inside, but it has been assumed that these are ingested secondarily from the crops of granivorous (Fox 1977) and frugivorous prey birds (S. Kross, *pers. comm.*).

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On 26 Mar 2010 at 0820 h, while carrying out behavioural observations on kea (*Nestor notabilis*) above the lower red tarns at Mt Sebastapol, Mt Cook National Park (43° 44.848'S, 170° 05.925'E), we saw an adult female falcon land on the ground ~30 m below our site and feed on the orange fruits of *Leucopogon fraseri* (Ericaceae) for 25 seconds. The falcon remained there for another 10 seconds and during this time defecated, and then it flew away. We then collected the faecal sac and counted 1 *Leucopogon fraseri* seed and 62 *Gaultheria depressa* (Ericaceae) seeds. All seeds were intact. Also present and identifiable were fruit skins and invertebrate remains.

Our observation describes the first evidence of frugivory by the New Zealand falcon. It is unclear whether this behaviour is restricted to alpine fleshy fruits, or even whether it is relatively common and widespread. However, our observations suggest that the potential for long distance dispersal of alpine seeds by falcons via both primary and secondary seed dispersal is possible. Given the paucity of extant dispersal agents in the alpine zone, New Zealand falcons could potentially be important seed dispersers for fleshy-fruited plants inhabiting open high-country ecosystems.

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