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SHORT NOTE

Observations of New Zealand kingfisher (*Todiramphus sanctus*) foraging on insects associated with artificial sugar-water feeders

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Feeding birds in residential backyards is becoming more popular worldwide, and allows residents to connect with nature (Cox & Gaston 2016). The popularity of urban bird feeding is probably driven by birds, unlike other life forms, being conspicuous and associated with aesthetic pleasure (Jones 2018). However, while often aimed at supporting specific birds, these feeders can attract other animals that take advantage of opportunities associated with supplementary food. For example, seed feeders set out for granivorous birds are often visited by other granivores, such as squirrels (Sciuridae), rats (*Rattus* sp.), and raccoon (*Procyon lotor*), as well as predatory birds that take advantage of the aggregation of prey species (Hoff 2005).

In New Zealand, feeding birds in residential backyards is a popular practice (Spurr 2012), with a recent study identifying about half of New Zealand households feeding birds in their gardens (Galbraith *et al.* 2014). Furthermore, almost 20% of households provided sugar-water, a food source aimed at attracting native nectarivorous birds (Galbraith *et al*. 2015). Our research focusses on the effect of residential garden sugar-water provisioning on the behaviour and health of native New Zealand nectarivorous bird species, such as tūī (*Prosthemadera novaeseelandiae*, hereinafter binominal nomenclature follows Gill *et al*. 2010), bellbird (*Anthornis melanura*), and silvereye (*Zosterops lateralis*).

Sugar-water feeders are becoming an increasingly prevalent means of encouraging native birds to New Zealand gardens, but they also have potential to attract insects, such as Hymenoptera (particularly bees, wasps, and ants) or Diptera (flies), to a concentrated food source, which in turn may act as a food source for insectivores. Here we report on a previously unpublished observation that occurred during behavioural data collection associated with our sugar-water feeder project. One of the authors (DAE) observed a New Zealand kingfisher (*Todiramphus sanctus vagans*) foraging for flies attracted to a sugar-water feeder.

Kingfishers (Halcyonidae) are a group of conspicuously coloured birds distributed throughout the world (Woodall 2001). Some of these birds are associated with water and aquatic prey, caught via aerial attack from a perch (Schockert 1998; Laudelout & Libois 2003; Libois & Laudelout 2004; Čech & Čech 2015). However, some species, particularly those inhabiting inland habitats, prey on a wide range of small animals (Ali 1996; Soud *et al*. 2010). The New Zealand kingfisher has a diverse range of prey, including lizards (Mead 1947; O'Donnell 1981; van Winkel & Ji 2012), crabs, tadpoles, crayfish, small fish, insects, spiders, mice,

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and small birds (McKinlay 2013).

In November 2018, the volunteer householder at one of our study gardens alerted us that he had observed a kingfisher visiting his garden occasionally ("sometimes every day, but then gaps of several weeks"; not specific to a season) throughout the preceding two years. The householder, whose garden is located in the Grey Lynn suburb of Auckland (coordinates 36.860°S, 174.737°E), and who has been providing birds with sugar-water for the last five years, witnessed a kingfisher foraging on the insects visiting one of his two feeders in early afternoons. The householder was unable to give us more details on the nature of these insects; however, he observed "some big flies" around the feeder. One of the authors (DAE) also observed bees visiting the feeder on the 30 November 2018 and 14 August 2019. The feeder in question was a hand-made feeder, a wooden trough design, permanently installed on a tree. This open-style construction does not exclude insects and should not prevent larger birds, such as kingfishers, from catching insects feeding on the sugar-water. Later, on the 12 December 2018, 9 June, and 14 August 2019, DAE saw or heard a kingfisher in this garden (a total of 4 times) during behavioural observation periods, but never witnessed it foraging there.

One of the other study gardens is located within the same suburb, only 1.5 km away from the aforementioned garden. Although the householder reported observing a kingfisher in his garden from time to time, we had never observed any individuals of this species in the garden. However, on the 14 August 2019, DAE was collecting behavioural data in this garden and saw a kingfisher visit the backyard three times despite a resident tūī pair vigorously attempting to chase it away. This unusual behaviour was conspicuous to the observer. When the pair of tūī moved out of the garden, the kingfisher entered the garden again and perched within the large gingko tree (*Ginkgo biloba*) to which the feeder was attached (Fig. 1). This feeder is a commercial aviary feeder type, which consists of a 3 L inverted white plastic bottle on an open dish, within a wooden frame. A few moments later the kingfisher slightly turned to face the feeder, then plunged swiftly downward. As the bird reached the feeder, it hovered for less than a second at the feeder and caught a large black fly crawling on the outside of the feeder bottle. Immediately after catching its prey, the kingfisher beat its wings vigorously to gain height and flew away from the garden. The feeder bottle was white, so provided an easy visual contrast for the kingfisher to detect insects.

Other studies have found that kingfishers, such as white-breasted kingfisher (*Halcyon smyrnensis*), include Diptera (flies) and Hymenoptera (bees, wasps, ants) in their diet (e.g. Asokan *et al*. 2009).

Figure 1. The feeder at which the New Zealand kingfisher behaviour was recorded. The white feeder colour made visiting insects conspicuous.

However, to the best of our knowledge there are no previous published observations of kingfishers in either New Zealand or elsewhere hunting for insects at sugar-water feeders. Thus, this is a single documented observation of a kingfisher taking advantage of sugar-water feeder confirmed by anecdotal observation (as reported by a householder).

Given we never marked individual kingfishers (e.g. via colour banding), we can only speculate if the observed behaviour could be a learned behaviour, potentially of a single bird visiting the two gardens in Grey Lynn. However, this assumption might be supported by the fact that such a feeding behaviour is expected to be quite rare due to the low expected population density of kingfishers in the highly urbanised inner city suburbs of Auckland (Gill 1989; Heggie-Gracie 2016) and given sugar-water feeders serve as a very unnatural and inconsistent supplementary food source. It would be interesting to investigate the potential for sugar-water feeders to support other garden insectivorous species, such as New Zealand fantail (*Rhipidura fuliginosa*) and grey warbler (*Gerygone igata*), through attracting and concentrating insects to a source point. Tūī, bellbird, and silvereye also include invertebrates such as Diptera species (Roper 2012) in their diet, especially during the breeding season (Kikkawa 1968, 1961; Gravatt 1971, 1970; Craig *et al*. 1981; Kikkawa *et al*. 1986; Murphy & Kelly 2003; Spurr *et al*. 2011; Roper 2012). Thus, this would be an additional "opportunistic" food source for these native species contributing to more available resources. The latter may support increased reproduction, hence higher densities in urban areas if it translates into increased reproduction. However, there are also a number of

potentially negative effects. First, the discovery of a new insect source by introduced insectivorous birds, might lead to physical exclusion of smaller native nectarivores, such as silvereyes, that cannot compete for feeder access with larger birds (DAE *pers. obs*.). Second, kingfisher diet includes small birds (McKinlay 2013), so there is a risk of predation of smaller birds, such as silvereyes. Such predation may then have a negative influence on householders' attitudes to sugar-water feeding.

We encourage other researchers and/or observers to report any events of invertebrate consumption by insectivorous birds at sugar-water feeders in New Zealand gardens, so that we might better understand the prevalence of this behaviour and the potential importance it may have for native urban bird communities.

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