

SHORT NOTE

Kākā (*Nestor meridionalis*) investigate and depredate kakaruai (South Island robin *Petroica australis australis*) eggs

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During routine nest checks as part of a research project focusing on a kakaruai (South Island robin *Petroica australis*) population inside Te Korowai o Mihiwaka/Orokonui Ecosanctuary, Aotearoa/New Zealand (14°13'51"E, 49°28'41"N), we witnessed two kākā (*Nestor meridionalis*) approach a kakaruai nest and one kākā destroy the eggs. The observation was made on 12 October 2022, roughly halfway through the kakaruai breeding season. Located approximately 20 km from Ōtepoti/Dunedin, the 307 ha fenced ecosanctuary consists of both regenerating and indigenous podocarp and

broadleaf forest. Here we describe the circumstances of this observation and acknowledge that this is the first recorded case, to our knowledge, of such an interaction.

The kakaruai nest (~10 cm in diameter) was located about 1.8 m above ground on a semi-exposed platform within the trunk of a dead ponga/silver fern (*Cyathea dealbata*). The female began nest building on 9 September, and eggs were laid nine days later on 18 September, making the eggs 24 days old when our observation was made. It is worth noting that the average incubation period for kakaruai is 18 days (Powlesland 1997).

Received 21 November 2022; accepted 30 January 2023

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The nest was observed from the public path about five metres away every three to four days since nest-building commenced. Flagging tape was attached to a tree adjacent to the ponga (~1 m away) when the nest was built to help with future observations. On 12 October 2022 at 1230 h, when the female left the nest, an observer (MP-F) walked directly up to the nest to inspect the eggs and check whether they had hatched. We had not realised two kākā had been in the vicinity, and when we left the nest tree to take notes from the path, they immediately proceeded to climb up to the nest. One of them inspected the contents of the nest, then held one egg in its beak and promptly crushed it open. It picked away the eggshell and manipulated the embryo for a couple of seconds, then returned the egg to the nest and climbed down the tree. The other kākā, which had been watching the whole time, then followed. A minute later, both climbed back up the nest, and the same kākā that had crushed the first egg returned and crushed the second of the two eggs. In both instances, the embryo was not eaten. After a few seconds of inspecting this second egg, both kākā left. We monitored the nest for an additional five minutes but neither kākā returned. The interaction between the kākā and the nest took less than three minutes. During this process, the male and female kakaruai remained close to the nest and observed the kākā destroy the eggs. Neither of them attempted defensive strategies to protect the nest.

It was possible that the embryos were deceased before the depredation event. One week before this observation, an uncharacteristically cold two days in combination with spring snow had caused six other kakaruai nests of a similar developmental stage to fail. On the days of 6–7 October average daily temperature was 1°C compared to the 10°C average over the month of October 2022 (National Institute of Water and Atmospheric Research [NIWA] 2022).

To our knowledge, there are only two other known observations of kākā destroying the eggs of other birds. The first was made in 1999 at Nelson Lakes National Park, where a radio-tagged female kākā preyed on a riroriro (grey warbler *Gerygone igata*) nest. The kākā removed the top section of the nest and ate two or three eggs (L. Moran *pers. comm.*, 24 October 2022). The second instance of this behaviour was made in 2002, also within an ecosanctuary (Karori; now known as Zealandia). A pair of kākā removed eggs from a Eurasian blackbird (*Turdus merula*) nest (roughly 3–4 m above ground) and dropped them only to watch them smash (Batcheler & Batcheler 2002). The same bird did this three times. The nest was located on an accessible fork of a tree and was highly conspicuous. Only in the Nelson observation was the kākā recorded eating the embryo. This kākā behaviour has also

been suspected as the cause of multiple nest failures in the closely related toutouwai (North Island robin *P. longipes*) population in Zealandia (R. Shaw *pers. comm.*, 9 November 2022).

Kākā are sequential specialist foragers (O'Donnell & Rasch 1991), meaning they move between different resources throughout the year to account for seasonal differences in food availability. Their usual diet consists of wood-boring invertebrates (a major protein source being the larvae of kanuka longhorn (*Ochrocydus huttoni*), scale insects (consuming both the insect and the honeydew they produce, for example *Ultracoelostoma assimile*; Beggs & Wilson 1991), as well as seeds, nectar, fruits, and sap (Beggs & Wilson 1991). Kākā primarily feed from Podocarpaceae canopy species, including rimu (*Dacrydium cupressinum*), miro (*Prumnopitys ferruginea*), and Hall's totara (*Podocarpus laetus*). They also utilise species within the family Myrtaceae, including southern rātā (*Metrosideros umbellata*; O'Donnell & Dilks 1994). In a study focusing on a population with a similar ecosystem as Orokonui (broadleaf forest in South Westland), kākā spent most of their foraging time collecting wood-boring insects (O'Donnell & Dilks 1994). They do this only when alternative sources of protein and fat, like those found in seeds and fruit, are unavailable (Beggs & Wilson 1991). Kākā are considered more neophobic than the closely related kea (*Nestor notabilis*; Diamond & Bond 2004). Unlike kākā, opportunistic kea are also known to consume meat from sources other than invertebrates (Schwing 2010), including carrion (deer, chamois, tahr, and sheep carcasses) throughout their range, as well as prey on Hutton's shearwater (*Puffinus huttoni*; Cuthbert 2003), whio (*Hymenolaimus malacorhynchos*; Whitehead *et al.* 2008), and tokoeka (southern brown kiwi *Apteryx australis*; Checklist Committee 2022; Tansell *et al.* 2016). However, juvenile kākā have demonstrated innovation and flexibility in their explorative behaviour (Loepelt *et al.* 2016), showing higher persistence and exploratory diversity than adults.

Although our observation was only the third recorded incident, kākā likely employ these exploratory tactics more often than has been documented. Kākā spend a significant proportion of their foraging time high in trees (O'Donnell & Dilks 1994) where other bird species are likely to build nests, so it is not surprising that they would come across these novel food resources and have no choice but to give in to their explorative nature and investigate them. It is worth acknowledging that both kākā and kakaruai are thinly dispersed outside the safety of ecosanctuaries. Outside of these areas, predation webs are often dominated by introduced species (see Carpenter *et al.* 2021) as opposed to native species.

The two native parrot species in Aotearoa/New Zealand described here (those belonging to the order Psittaciformes; see Checklist Committee 2022) are unusual in their consumption of animal matter in comparison to the strictly herbivorous diets of many of the other world's parrots (Higgins 2001). The more general diets of these parrots in Aotearoa may be partly due to the different evolutionary pressures experienced in an island ecosystem lacking mammalian predators and competitors in combination with high levels of cognitive abilities and playfulness (Huber & Gajdon 2006). This observation contributes to the list of behaviours that make Aotearoa/New Zealand birds unique. In addition, it adds to our understanding of species' interactions in ecosystem restoration projects.

ACKNOWLEDGEMENTS

We would like to acknowledge the mana whenua of Te Korowai o Mihiwaka, Kati Huirapa Runaka ki Puketeraki. We want to extend our thanks to Orokonui Ecosanctuary staff, in particular, Elton Smith as well the Orokonui Knowledge Group, for allowing us to conduct our research within the beautiful sanctuary. This project was made possible through funding from the Ministry of Business and Innovation under contract C09X1805 'More Birds in the Bush' to Manaaki Whenua – Landcare Research and from the University of Otago. All nest monitoring was conducted under DOC authorisation 97675-FAU, and Animal Ethics permit AUP-22-39. Thank you to Colin Miskelly, Ron Moorhouse, Les Moran, and Rachael Shaw for directing us to and providing help with previous observations, and Jo Monks for editorial support. Lastly, I wish to acknowledge two kakarua parents that lost their tamariki that day. Kua whetūrangitia kōrua (return, and take your place amongst the stars along with your ancestors that adorn the sky).

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Keywords: kākā, *Nestor meridionalis*, South Island robin, *Petroica australis*, predation, mesopredation, foraging behaviour, nesting, exploration, Orokonui, ecosanctuary