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SHORT NOTE

Nest re-use by dunnocks (*Prunella modularis*) in New Zealand: an uncommon behaviour revealed through a long-term study

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Most species of birds build a nest to provide a warm and safe environment in which to incubate their eggs and rear young (Collias 1964). Nests can be used only once, and a new one built for each subsequent nesting attempt, or re-used either within- and between-seasons. Nest re-use appears to be more common in species where individuals face fierce competition for nesting sites. For example, nest re-use is common in cavity, cliff and colonial nesting species (Shields 1984). Open nesting passerines, on the other hand, are thought to construct new nests for each breeding attempt (Lindell 1996). However, since the 1950s more than 30 species of passerines have been observed reusing nests within a breeding season (Ellison 2008). Nevertheless, detecting nest re-use in open nesting species and understanding why it occurs is challenging, because the events of nest re-use are very rare even in species in which it has been reported.

Within-year nest re-use in passerines was first reported in American robins (*Turdus migratorius*) (Nickell 1957) and field sparrows (*Spizella pusilla*) (Allaire 1964). More recent observations of nest re-use include great reed warblers (*Acrocephalus arundinaceus*) in Romania, bramblings (*Fringilla montifringilla*) in Norway (Hafstad *et al.* 2005) and black capped vireos (*Vireo atricapilla*) in the USA (Boves *et al.* 2013). While these observations provide information on the occurrence of nest re-use across species, such anecdotal reports do not allow us to infer the frequency of nest re-use behaviour within populations. Population-level studies have mainly reported a very low rate (< 2%) of nest re-use in open nesting passerines (Briskie & Sealy 1988; Friesen *et al.* 1997; Cavitt *et al.* 1999; Aguilar & Marini 2007; Zielinski 2012), although higher rates

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of nest re-use (range 7%-16%) have been observed in several species of tyrant flycatchers (Aguilar & Marini 2007; Redmond *et al.* 2007; Ellison 2008). Nest re-use in open nesting passerines is considered to be a strategy to reduce costs of nest building. Conversely, nest re-use may negatively affect breeding success if, for example, re-used nests are less structurally stable or harbour higher parasite loads (Briskie & Sealy 1988; Cavitt *et al.* 1999; Wysocki 2004).

Here we describe the first observations of nest re-use in an introduced population of dunnocks (*Prunella modularis*) in New Zealand. The events of nest re-use occurred within the same breeding season, in a population monitored since 2009, in the Dunedin Botanical Garden (45° 51′ S, 170°31′ E) (see Santos & Nakagawa 2013 for details). We found 414 nests (see Fig. 1 for an example of a dunnock nest) across 6 consecutive breeding seasons (2009-2015), 4 of which were re-used nests (0.96%). However, 3 of the 4 cases of nest re-use were observed during a single breeding season, in which we found and monitored 79 nests from September 2014 to January 2015.

First event of nest re-use: Female I (Band A183577 New Zealand Bird Banding Scheme) formed a polyandrous mating group with 2 males and the first nest was located on 18 October 2014. By 26 October, 3 eggs averaging 2.21 g (0.03 SD) were laid and incubated for 2 days until she abandoned the clutch. On 6 November she began to re-use her first nest. We did not observe any structural changes in the nest between the first and second nesting attempts. Four eggs averaging 2.34 g (0.04 SD) were laid in the second clutch, and she abandoned the nest after 4 days of incubation. On 26 November she built a new nest, in the same territory (12 m from the first nest), laid 3 eggs averaging 2.22 g (0.01 SD) and successfully fledged 1 chick.

Second event of nest re-use: Female II (Band A185154) formed a polyandrous mating group with 2 males. On 30 October we found her first nest. She was already incubating 2 eggs averaging 1.84 g (0.02 SD). One egg was cracked, and the second egg hatched, but the nestling died after 2 days. On 20 November we found her second nest (3 m from the first nest) where she laid 3 eggs averaging 2.41 g (0.03 SD). One egg was found cracked, the second egg was found unfertilised, and the third hatched, but the nestling perished after 7 days. On 4 January 2015 we found the female reusing her first nest. There were no obvious structural changes in the nest although the female added a new layer of feathers into the nest before it was reused. She was found incubating 2 eggs. She abandoned the nest 2 days after we found it. One egg was completely cracked, and the second egg was unfertilised (mass: 2.42 g).

Fig. 1. A typical dunnock (*Prunella modularis*) open-cup nest. The outside of the nest is formed by twigs. Moss is used to form an inner layer, and then the inside is lined with a small layer of feathers and hair. Photo: C. E. Lara.

Third event of nest re-use: Female III (Band A183151) formed a monogamous pair. On 13 October, we found her first nest. On 24 October she completed a 3-egg clutch, with eggs averaging 2.21 g (0.03 SD). Only 1 egg hatched, but the nestling died after 5 days. On 26 November, we found her second nest (55 m from the first nest). On 2 December, she completed a 3-egg clutch, with eggs averaging 2.17 g (0.05 SD). She erratically incubated the eggs (eggs were found cold and warm over a period of several days). On 18 December, she completely abandoned the nest. On 3 January 2015, she laid a new clutch of 3-eggs averaging 2.07 g (0.06 SD) in her second nest. We did not observe any structural changes to the second nest before it was reused. The female incubated the eggs for 16 consecutive days until she abandoned the nest. Two eggs were unfertilised and 1 egg contained a dead embryo.

The pattern of nest re-use we observed in dunnocks differed among individuals: female I re-used her first nest for a second breeding attempt immediately after she failed her first attempt, female II re-used her first nest for a third breeding attempt after failing in her first and second nest, and female III re-used her second nest for a third breeding attempt after failing in her first and second nest. Interestingly, all 3 events of nest re-use by dunnocks were preceded by and resulted in nesting failure, thus raising the question of why some females engage in this behaviour. Despite a potential positive effect of reducing energy and time costs

related to nest construction, nest re-use in dunnocks did not lead to any successful breeding attempts. Intra-specific competition for nest sites could also be the driver of nest re-use in this system, but females are mostly distributed in non-overlapping territories (comprising hedgerows, bushes and open woodlands), and we did not observe apparent differences between the composition of adjacent territories.

Regardless of the underlying function of nest re-use by dunnocks, our observations fit well with a growing literature of long-term studies, revealing very low re-use rates in open-cup nesters. While nest re-use behaviour was uncommon in our population (0.96% of nests re-used), this rate is similar to recent findings in other species (Cavitt *et al.* 1999; Zielinski 2012; Boves *et al.* 2013). The rarity of nest re-use, including in dunnocks, demonstrates that long-term studies are valuable in this regard. Such studies are likely to reveal nest re-use in more species of open-cup nesters, and perhaps help identify the reasons why it is so rare.

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