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SHORT NOTE

Nest sites of sympatric orange-fronted (*Cyanoramphus malherbi*) and yellow-crowned parakeets (*C. auriceps*)

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Before 1998 only 1 nest site of an orange-fronted parakeet (*Cyanoramphus malherbi*) had ever been reported (Taylor *et al.* 1986), and this was 10 m up a living red beech (*Nothofagus fusca*) tree in a cavity behind a knothole. While the orange-fronted parakeet was only a colour morph of the yellow-crowned parakeet (*C. auriceps*) such nest site data had no conservation value (Taylor *et al.* 1986; Turbott 1990). However, as the 150-year debate over the taxonomy of this very rare endemic New Zealand parakeet appears to have been resolved infavour of full species status (Boon *et al.* 2000), nest site data now have high conservation value. This is especially so because studies on hole-nesting yellow-crowned parakeet in the beech (*Nothofagus* spp.) forests of the Eglington Valley, Fiordland, have shown them to be vulnerable to introduced ground predators, such as stoats (*Mustela erminea*) and rats (*Rattus* spp.) (O'Donnell 1996; Elliott *et al.* 1996). As the orange-fronted parakeet is also a hole-nesting species restricted to South Island beech forests (Boon *et al.* 2000; Kearvell *et al.* 2002), it too is likely to be vulnerable to introduced mammalian predators.

During the summer of 1998/9 comparative ecological observations of sympatric orange-fronted and yellow-crowned parakeets were conducted in the South Branch of the Hurunui River (172° 5'E, 42° 45'W), Lake Sumner Forest Park (Kearvell *et al.* 2002). The observations were collected in a section of valley floor beech forest 7 km long and 600 m wide. The study site was divided into 2 areas each sampled along a fixed route on consecutive days using 1 of 6 randomly selected start points (Kearvell *et al.* 2002).

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While conducting this study I was able to detect nests of both species through observation of parakeets engaged in breeding behaviours. Sites where pairs of parakeets were observed nest hole searching were marked with flagging tape for later observation. Nests were also located when males were seen feeding females at or near a nest hole and when adults were seen feeding nestlings at a nest hole. All confirmed nests, containing an incubating female or nestlings (n=32), were permanently marked with cattle ear tags and GPS (Global Positioning System) co-ordinates recorded.

Several variables were recorded for each nest: height (m) above ground level; height (m) of nest tree; tree diameter (cm) at breast height (DBH), measured 1.5 m above ground on uphill side; aspect of nest hole in degrees (1-360), measured using a 'Silva' compass; tree species (including standing dead tree); site of nest (trunk or branch); and type of access hole (knot or slit). Vertical heights were measured directly with a 'Suunto' hypsometer. As part of the ecological study the forest structure of the site was surveyed using Plotless Sampling (Cottam & Curtis 1956). This note summarises the results of those nest site observations.

There was no indication from the data of any differences between the 2 species of parakeet in the height of their nests, nor in their choice of tree size as measured by DBH (Table 1). There was some indication that orange-fronted and yellow-crowned parakeets selected trees of different heights (P=0.06; Table 1). Data on beech tree species use (Table 2) indicated that yellow-crowned parakeets used silver beech (*N. menziesii*) significantly more frequently (at the 5% level) and red beech less frequently, when compared to the almost exclusive use of red beech by orange-fronted parakeets. There were no differences between the parakeet species and their choice of nest site and access hole, as measured by their use of trunk or branch

Table 1 A comparison of nest site dimensions between the orange-fronted parakeet (OF) (*Cyanoramphus malherbi*) and yellow-crowned parakeet (YC)(*C. auriceps*).

	OF (n=19)			YC (n=13)					
Variable	Mean	SD	Range	Mean	SD	Range	t	df	P
Nest tree height (m)	22.2	4.5	12-29	25	5.4	10-30	1.54	30	0.06
Nest height (m)	11.8	3.5	3.5-19.5	11.4	3.2	6-14.5	0.35	30	0.36
DBH (cm)	79.5	22.7	53-129	88.2	22.9	44-109	1.05	30	0.15

Table 2. A comparison of beech (*Nothofagus*) species use by orange-fronted parakeet (*Cyanoramphus malherbi*) and yellow-crowned parakeet (*C. auriceps*). *, mountain beech (*N. solandri var. cliffortioides*) and standing dead tree.

	Red beech	Silver beech	Other species*	χ^2	P
Orange-fronted parakeet	17	1	1		
Yellow-crowned parakeet	6	5	2	7.42	0.05

(χ^2, df=1, n=32, P=0.52) and use of knot hole or slit (χ^2, df = 1, n=32, P=2.079). Nor were any differences found between the parakeet species in their choice of nest aspect (χ^2, df = 3, n=32, P=0.41). However, the nest aspect data from both species combined showed a significant preference, at the 5% level, for a particular nest aspect (χ^2, df=3, n=32, P=10): most nests faced west (n=14) and very few (n=2) faced south.

These findings are similar to those of Elliott *et al.* (1996) for yellow-crowned parakeets in the Eglinton Valley, where most nests were in large old red beech frees with a DBH>70 cm and were usually accessed through knot holes. In this study most nests were also in red beech (Table 2) and most nests (23/32) were in frees with a DBH >70 cm. The mean DBH of trees on this study site was 45.1 cm (n=400, SD=22.7) and the mean canopy height was 20.7 m (n=142, SD=3.92). Both parakeet species in the South Branch of the Hurunui therefore chose large, old, mature trees, predominantly red and silver beech, of large diameter, and were on average taller than the mean canopy height (Table 1). As with the Eglinton Valley parakeets, most nests were accessed through knot holes (26/32) and were found in the trunks (25/32). Although the sample size of this study is relatively small, and hence the data should be interpreted with care, orange-fronted and yellow-crowned parakeets in the South Branch of the Hurunui seemed to select similar nest sites, although orange-fronted parakeets may have preferred large, mature red beech frees to other beech species.

This similarity in nest site selection between the Eglinton (Elliott *et al.* 1996) and the South Branch of the Hurunui poses significant problems for the orange-fronted parakeet. Both the parakeet species would appear to be as vulnerable to predators, such as stoats and rats, as yellow-crowned parakeets in the Eglinton Valley (O'Donnell 1996; Elliott *et al.* 1996; Spurr 1987). This has conservation management implications for the critically endangered orange-fronted parakeet because both stoats and rats are present at the only 2 sites (Hawdon and South Branch Hurunui Valleys, Kearvell *et al.* 2002) where the species survives.

Selection of similar nest sites could also mean that some interspecific competition between the 2 parakeet species might occur. If nest sites became limiting, as in a forest with few mature trees, this could place 1 species at a competitive disadvantage. The forest survey indicates, however, that there is a substantial number of mature beech frees of all 3 species. Of the 400 frees surveyed, 7.5% had a DBH > 60 cm. Trees of this size are c. 150 years old, or older (Wardle 1984), indicating that the forest in the South Branch of the Hurunui has undergone no major recent disturbances. This may mean that nest sites are numerous and not limiting.

Both parakeet species are reliant upon old mature beech frees for nesting, as it is only in older trees that suitable cavities and knot holes develop (Spurr 1987). Silviculture of beech forests aims to harvest when trees are even aged with DBH of 50-70 cm (Franklin 1981). As Elliott et al. (1996) pointed out, this means that very few frees will be old enough for holes to develop before they are harvested. Nest site selection by both species, in this study, is consistent with findings by Elliott *et al.* (1996): both parakeet species would be unlikely to find sufficient nest holes in managed beech forest.

In contrast to the findings of Elliott *et al.* (1996), who found no significant preference for parakeet nest aspect, I found that parakeets preferred to have a nest site facing the sun and definitely away from the shaded and colder side of the tree.

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SHORT NOTE

Delayed plumage maturation in the male North Island robin (*Petroica longipes*)

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Both sexes or just males of some passerines can breed before the adult plumage is attained (Goodwin 1986; Snow 1982), which Lyons & Montgomerie (1986) called delayed plumage maturation. As an extreme example, both male and female kakerori, or Rarotonga flycatcher (*Pomarea dimidiata*) do not attain the adult plumage until their 4th year (Robertson *et al.* 1993).

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The New Zealand robins (*Petroica* spp.) are small (*c.* 35 g), forest-dwelling, endemic passerines. Each is restricted to one of the 2 main islands of New Zealand and its associated offshore islands; North Island robin (*P. longipes*), and South Island robin (*P. australis*) (Holdaway *et al.* 2001). The Stewart Island robin (*P. a. rakiura*) is a race of the South Island species. In his revision of the New Zealand robins, Fleming (1950) described in detail the plumages of adult males, adult females, and fledglings of each form from museum specimens and observations of live birds. In general, for each