Responses of kukupa (*Hemiphaga novaeseelandiae*) and other birds to mammal pest control at Motatau, Northland

John Innes[1], Graham Nugent[2], Kevin Prime[3], Eric B. Spurr[2]
[1]Landcare Research, Private Bag 3127, Hamilton, New Zealand (E-mail: innesj@landcareresearch.co.nz)
[2]Landcare Research, P.O. Box 69, Lincoln 8152, New Zealand
[3]Prime Holdings Ltd., Motatau, R.D. 1, Kawakawa, Northland, New Zealand

Abstract: The kukupa or New Zealand pigeon (*Hemiphaga novaeseelandiae*) is gradually declining on the New Zealand mainland, due mostly to predation by introduced pest mammals including ship rats (*Rattus rattus*) and brushtail possums (*Trichosurus vulpecula*). We report on a co-operative project between Maori landowners, the Department of Conservation, and Manaaki Whenua–Landcare Research researchers to restore a Northland kukupa population and to examine kukupa nesting success in relation to pest abundance. Ship rats and possums were targeted by trapping and poisoning throughout Motatau Forest (350 ha) from 1997 to 1999; only possums were targeted in 2000. All 13 kukupa nests located before pest control started in late 1997 failed at the egg stage, but all seven nests located in 1998–99 successfully fledged young when trapping and tracking indices of possums and ship rats were less than 4%. After pest control, counts of kukupa and some other bird species increased at Motatau compared with counts in a nearby non-treatment block, suggesting numbers of adult kukupa can be increased in small forest areas by intensive pest control. This increase is due at least partly to increased nest success. Evidence from time-lapse video cameras, sign remaining at nests, and nest success rates under different pest control regimes suggest both ship rats and possums are important predators at kukupa nests.

Keywords: brushtail possums; co-management; kukupa; New Zealand pigeon; pest control; ship rats.

Introduction

The kukupa (Maori dialectical variation for kuku, kereru, New Zealand pigeon; *Hemiphaga novaeseelandiae*) is a forest pigeon endemic to New Zealand. The status of many kukupa populations is uncertain (Mander *et al*., 1998), but a 1993 survey in Northland indicated a 50% decline in 14 years (Pierce *et al*., 1993), and studies at three other mainland sites suggested adult mortality rates exceeded recruitment from reproduction (Clout *et al*., 1995). Recent Department of Conservation reclassification of bird species according to threat of extinction rated kukupa as in 'Gradual decline'. This was defined as having a "…predicted decline of 5–30% in the total population in the next 10 years due to existing threats, and the decline is predicted to continue beyond 10 years" (Molloy *et al*., 2002; R. Hitchmough, Dept. of Conservation, Wellington, N.Z., *pers. comm*.). Internationally the species is classified 'near threatened' (Birdlife International, 2000). The kukupa has some key features in common with another more highly threatened endemic, the kokako (scientific names of all bird species are in the Appendix), being of similar size, living in tall indigenous forest, and building simple open nests.

Control of mammalian pests, especially brushtail possums (*Trichosurus vulpecula*), ship rats (*Rattus rattus*) and stoats (*Mustela erminea*), is the key management action to help kukupa and kokako populations recover, because this minimises predation of eggs, chicks and adults, and maximises the availability of fruit (Pierce and Graham, 1995; Anon., 1996; Mander *et al*., 1998). Predation is the main driver of population decline, although food supply may determine how many breeding attempts are made. What is not known is how predation rates vary with pest density, and in particular the 'threshold' density above which predation forces the bird population into decline. This information is essential in helping managers design pest control regimes that provide adequate protection at minimum cost.

The opportunity to examine kukupa nesting success at a range of pest densities was provided by a 4-year research-and-management partnership involving tangata whenua (Maori landowners), the Department of Conservation and researchers at Motatau, Northland, starting in 1996. The vision for the project came from Te Runanga o Ngati Hine, who were formally recognised as co-managers of the forest in 1994 by the

Department of Conservation. Ngati Hine wished to increase kukupa numbers and to restore the overall health of Motatau forest so their children could relate to the forest as their elders had. The Department of Conservation undertook to fund and organise annual pest control in Motatau forest. Landcare Research, a Crown Research Institute, facilitated the initiation of the project and monitored its outcomes for vegetation, kukupa and other birds.

This paper reports kukupa breeding success, and the abundance of kukupa and other birds, in relation to the abundance of key mammalian pests (ship rats and brushtail possums), and attempts to define which pests need to be controlled at what levels to protect kukupa and similarly threatened species.

Study areas

Motatau forest is a 350-ha remnant of podocarp-broadleaved forest located midway between Whangarei and Kaikohe, Northland, just east of Motatau peak (560 m a.s.l.; 35° 36'S, 174° 04'E). Okaroro forest, a 300-ha non-treatment block, is 8 km northwest of Motatau forest. In both forests, the canopy is dominated by taraire (*Beilschmiedia taraire*) and kohekohe (*Dysoxylem spectabile*), with abundant totara (*Podocarpus totara*) and kahikatea (*Dacrycarpus dacrydioides*) on forest edges. Common understorey plants are nikau (*Rhopalostylus sapida*), mamaku (*Cyathea medullaris*), mahoe (*Melicytus ramiflorus*) and five-finger (*Pseudopanax arboreus*).

Motatau forest is fully fenced and domestic stock are now excluded from the block. However, cattle were grazed in Okaroro forest each winter during this project, so ground-level vegetation there was much sparser than at Motatau.

Methods

We used an unreplicated BACI (Before-After/Control-impact; Underwood, 1993) experimental design to compare the changes in the abundance of common bird species over 4 years. Monitoring was begun in 1996, with intensive pest control (the experimental treatment) beginning in spring 1997. We confirmed that the experimental treatments had been implemented as required by this design by measuring indices of pest abundance in both study blocks. To provide supporting evidence of a causal link between pest abundance and kukupa abundance we also monitored kukupa nesting success at Motatau (but not at Okaroro).

Experimental treatment: pest control

Ship rats and brushtail possums were targeted annually throughout Motatau forest from 1997 to 1999, with various toxic baits (Table 1) presented in 'Philproof' bait stations. Bait station lines were 150 m apart, with stations at 100 m spacing along lines. All control aimed to have these pests reduced to low numbers by October or November each year, the time of year when kukupa nesting peaks (Pierce and Graham, 1995). Pest numbers were initially (1997) knocked down with 1080 (sodium monofluoroacetate). Low numbers were then maintained with brodifacoum until a policy change by the Department of Conservation in January 2000 precluded its use at Motatau. In 2000, control focused mainly on possums through the use of baits with cyanide and cholecalciferol. This allowed us to examine the nesting outcome for kukupa when rats alone were abundant.

Some stoats, ferrets (*Mustela putorius*) and feral cats (*Felis catus*) would have been killed by secondary poisoning when 1080 and brodifacoum were used to target possums and ships rats (Gillies and Pierce,

Table 1. Baits and toxins placed in bait stations to target ship rats and brushtail possums at Motatau, Northland, 1997–2001.

Date	Method
October 1997	Three pre-feeds of non-toxic pollard bait, followed by cinnamon-lured, pollard baits (1 kg per station) at 0.15% 1080 loading. One week later, all remaining 1080 baits were replaced by 1 kg Pestoff (brodifacoum) baits.
January 1998	1 kg Pestoff per station
March 1998	500 g Pestoff
May 1998	500 g Pestoff
August 1998	300 g Pestoff
November 1998	300 g Pestoff in perimeter bait stations only
March 1999	300g Pestoff
August 1999	300 g Pestoff
September 2000	1 Feratox (cyanide) capsule in 10 g Feracol (cholecalciferol) paste; 5 per station plus 5 between (nominally at 20 m spacing).
November 2000	1 Feratox (cyanide) capsule in 10 g Feracol (cholecalciferol) paste; 3 per station plus 5 between.
November 2001	1 Feratox (cyanide) capsule in 10 g Feracol (cholecalciferol) paste; 3 per station plus 5 between.

1999; Murphy *et al.*, 1999). These carnivores were also targeted by trapping during 1997–2000. Up to 100 Mark IV Fenn traps were placed in tunnels at 'best sets' along major ridges, tracks, the edges of banks and streams, around the perimeter of the block, and at good sites up to 500 m from the block. In addition, cattle were excluded from the forest and most of the goats present were shot, resulting in a noticeable increase in the abundance of ungulate-preferred species in the understorey.

We used a slightly modified version of standard procedures to obtain indices of the abundance of possums (National Possum Control Agency, 2000) and ship rats (Gillies and Williams, 2001). These were:

1. Possums. Number of possums trapped per trap-night, expressed as a percentage (trap-catch rate), calculated from 100 leg-hold traps set for 3 fine nights on wooden Scott boards set above the ground to protect brown kiwi. Traps were set on 5 lines with 20 m spacing between traps [see Nugent *et al.* (2002) for more detail]. The index was corrected for sprung traps as described by Nelson and Clark (1973).
2. Ship rats. Percentage of footprint tracking tunnels tracked by rats in one night. We initially used the chemical tracking system of King and Edgar (1977), but changed to using red food-dye in November 1998. There were 100 tunnels set at 50-m spacing on four lines of 25 tunnels in both Motatau and Okaroro. Tunnels were baited with peanut butter and set on the same night in both blocks.

There were no methods suitable for monitoring numbers of stoats, ferrets and feral cats other than trap-catch rates at Motatau. Low catch rates plus differences in baiting and other trapping techniques prevent this index being comparable with those from other blocks.

Responses in bird abundance

Kukupa and other birds were counted annually from 1996 to 2001 during November to mid-December with the five-minute count technique (Dawson and Bull, 1975) at both Motatau (starting 1996) and Okaroro (starting 1997). There were 27 count stations at Motatau and 28 at Okaroro. Stations were at 200-m intervals along lines that traversed representative vegetation and terrain in both forests. Two observers counted simultaneously in the two blocks on a day, then swapped blocks. Two counts by each observer (total four) were made in each block each year except 2001 when poor weather reduced counts to one per block.

Statistical analyses of these data tested whether changes through time in mean bird counts differed between the two areas, consistent with the hypothesis that pest control at Motatau had an effect. The lack of replication in this study means that any pest control effects are confounded with area differences, so inference from statistical analysis is weak. Count data for each species were assumed to follow a Poisson distribution since count numbers were generally low and the count variance increases with its mean. Data were analysed by fitting generalised linear models in S-Plus 6 (Insightful Corporation, 2001). A factor for 'station' was included to allow for station differences, as well as for date and the interaction between date and area. Only the latter interaction was of interest. A likelihood ratio test (Chi-square) was used to compare models with and without the date-area interaction term. A second index of kukupa abundance was obtained at Motatau from counts of display flights (Mander *et al.*, 1998). Counts were conducted weekly for a 30-minute period soon after daybreak from the same vantage point near Kaitoki camp. In total, 105 counts were undertaken between August 1996 and January 2001. This observation point gave good views of the whole catchment of the Kaitoki Stream, which comprises about 20% of the area of Motatau Forest. No display flight counts were made at Okaroro forest, or at Motatau in the 1997–98 breeding season. Counts were not subjected to statistical analysis due to lack of replication.

Kukupa nesting success

Most nests (30 out of 44) were found by following radio-transmittered birds, because kukupa make few visits to nests, and because the tall and dense forest canopy usually obscured the view of kukupa flight paths.

Twenty-three kukupa were mist-netted, weighed, banded, colour-jessed and had radio transmitters attached between January 1997 and November 1999. Playing recorded kukupa wingbeats greatly increased capture rates. Transmitters were RI-2C models, made by Holohil Systems Ltd., Canada, and weighed 7.8–9.6g with harnesses. Harnesses were the 'backpack' type, made by Sirtrack Ltd., New Zealand. They incorporated a thread weak-link that enables shedding of the transmitter if it snags on vegetation (Karl and Clout, 1987). Only two kukupa were recaptured.

Nests were visited at least weekly to determine their fate. Causes of failure were identified either by time-lapse photography (Innes *et al.*, 1994) or by diagnosis of the sign remaining at nests (Brown *et al.*, 1996). For each breeding season, the percentage of nests that produced fledglings was used as our index of breeding success. This index is valid only if nests are found soon after laying (Armstrong *et al.*, 2002). In this study, most nests (77%) were either located quickly with the use of radio-transmitters on breeding birds, or were found while the nest was being built.

Results

Residual abundance of ship rats and possums

Ship rat tracking rates at Motatau declined to zero after the 1080 operation in October 1997 and remained very low (< 4%) until 3 months after the final bait station fill of brodifacoum in August 1999 (Fig. 1a). Tracking rates increased thereafter, and were not greatly reduced by the cyanide and cholecalciferol operation that started in September 2000. At Okaroro, where no poisoning was done, rat tracking rates curiously followed those in the treatment block 8 km away, although the first index at Okaroro after 1080 was applied at Motatau was 16%, higher than at Motatau (0%).

The pre-fed 1080 operation at Motatau in 1997 halved the possum trap-catch rate, from 26% to 12%, and no subsequent index exceeded 7%, whereas indices remained very high at Okaroro throughout the project (Fig. 1b).

Changes in bird abundance

Kukupa counts increased significantly at Motatau (the treatment block) but not at Okaroro during the period of pest control ($P = 0.01$; Fig. 2a), consistent with the

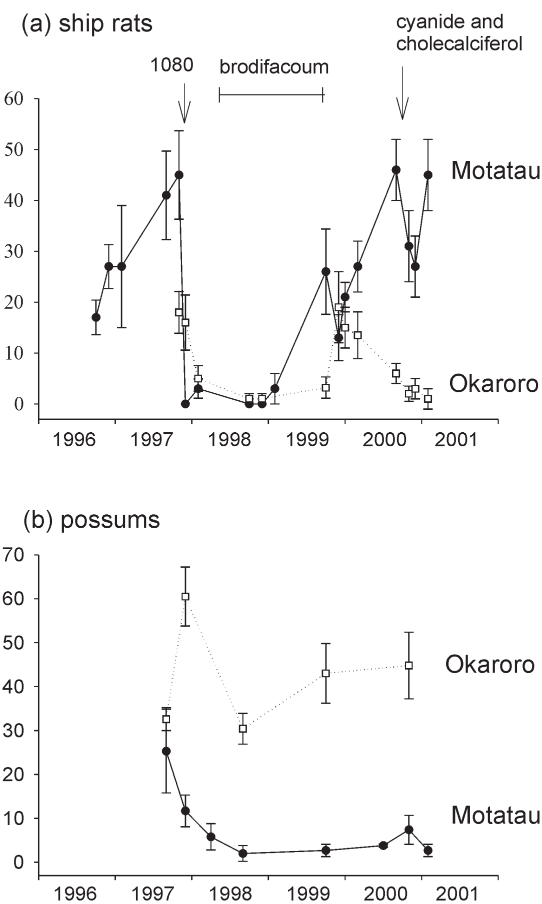

Figure 1. Abundance indices (± S.E.) of (a) ship rats and (b) possums at Motatau (treatment block; solid circles) and Okaroro (non-treatment block; hollow squares) before and after various poisoning operations at Motatau. The timing of the Motatau pest control operations indicated in the upper graph applies also to the lower.

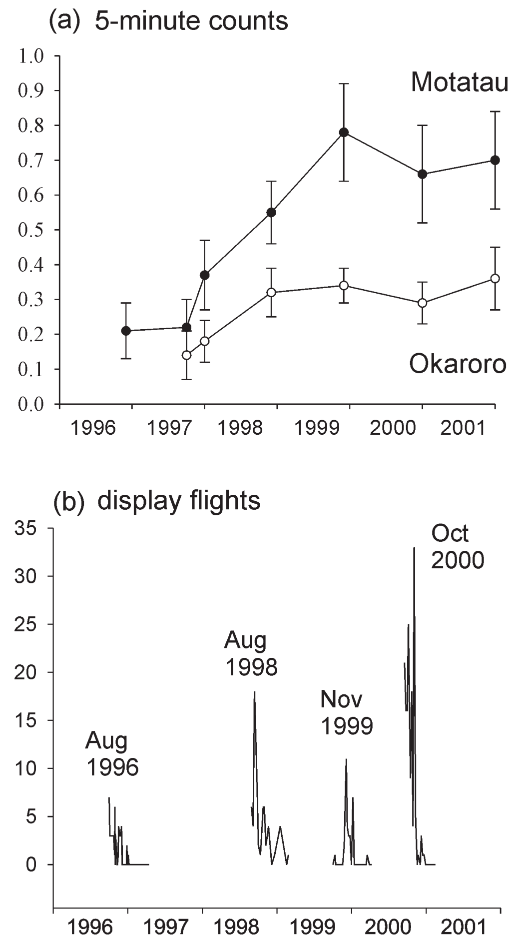

Figure 2. (a) Mean (± S.E.) number of kukupa per 5-minute count at Motatau (pests controlled; solid circles) and Okaroro (pests not controlled; hollow circles), Northland. Poisoning began in October 1997. (b) Number of kukupa display flights per half-hour observation period at Motatau. No counts were made in 1997–98 breeding season. The given months and years are the dates of peak counts each season.

hypothesis that mammal pests limited kukupa numbers before poisoning began. Counts more than trebled, from a mean of *c*. 0.2 kukupa per station before pest control to nearly 0.8 per station after 2 years.

The maximum number of kukupa display flights counted increased from 11 in August 1996 before pest control started, to 33 in October 2000 after 3 years of control, although there was a decline in the 1999–2000 season. Counts varied greatly from week to week, and the maximum count occurred in different months in different years (Fig. 2b).

Counts of chaffinches, eastern rosellas, mynas and tui also increased significantly at Motatau compared with Okararo during 1997–2001, while counts of grey warblers, pheasants and silvereyes increased significantly at Okaroro (Table 2).

Kukupa nesting success

A total of 44 kukupa nests were found, between 4 and 16 nests each year (Table 3). All 13 nests located between September 1996 and October 1997 (before pest control) failed at the egg stage, mostly due to predation. Three of another four nests found during late October–early December 1997, after pest control started, also failed. One was abandoned after a full-term incubation, one chick died for unknown reasons, and one egg was eaten by an unidentified predator. A chick fledged from the fourth nest, but only after 6 possums were trapped at the tree base during nesting. Sign left at nests, especially crushed infolded eggshell pieces (Brown *et al.*, 1996), suggested possums were responsible for most predation in the first 2 years of the project.

In 1998–99, however, when both possum and rat indices were less than 4%, all seven located nests successfully fledged young. Few breeding attempts were made in 1999–2000 and we located only four nests, of which one succeeded, two were abandoned, and one was eaten by an unknown predator.

In 2000–01 ship rats had become abundant (mean

Table 2. Differences in changes in mean November 5-minute bird counts during 1996–2001 at Motatau (pests controlled from October 1997 onwards) *cf*. Okaroro (pests not controlled). *P* values < 0.05 indicate a significant interaction between date and area (treatment *v*. non-treatment). No counts were undertaken in Okaroro until 1997. We regarded counts of sixteen other species as too sparse to warrant their presentation here. Scientific names of all bird species are in the Appendix.

Species	*P* value		Mean no. of birds per station					
			1996	1997	1998	1999	2000	2001
Significant increase at Motatau *cf*. Okararo								
Chaffinch	0.01	Motatau	0.48	0.41	0.66	0.56	0.43	0.39
		Okaroro	NA	0.21	0.28	0.53	0.44	0.46
Eastern rosella	< 0.01	Motatau	0.96	0.63	0.93	0.91	1.01	0.85
		Okaroro	NA	0.04	0.40	0.62	0.29	0.55
Kukupa	0.01	Motatau	0.21	0.22	0.56	0.78	0.66	0.70
		Okaroro	NA	0.14	0.32	0.34	0.28	0.36
Myna	0.01	Motatau	0.02	0.22	0.35	0.20	0.68	0.46
		Okaroro	NA	0.29	0.30	0.25	0.30	0.09
Tui	< 0.01	Motatau	0.89	1.26	1.45	1.00	1.35	1.54
		Okaroro	NA	0.57	0.94	0.53	0.61	0.79
Significant increase at Okaroro *cf*. Motatau								
Grey warbler	0.01	Motatau	1.68	1.78	1.29	1.28	1.37	1.44
		Okaroro	NA	0.93	1.53	1.49	1.44	1.73
Pheasant	0.04	Motatau	0.01	0.04	0.09	0.22	0.18	0.09
		Okaroro	NA	0.04	0.20	0.45	0.10	0.25
Silvereye	0.01	Motatau	0.57	0.41	0.93	1.57	1.12	0.78
		Okaroro	NA	0.89	1.46	1.49	1.41	1.68
Not significantly different between blocks over time								
Fantail	0.13	Motatau	0.36	0.56	0.48	0.52	0.43	0.41
		Okaroro	NA	0.43	0.72	0.70	0.61	0.93
Kingfisher	0.11	Motatau	0.39	0.56	0.36	0.59	0.39	0.37
		Okaroro	NA	0.82	0.53	0.59	0.46	0.59
Shining cuckoo	0.29	Motatau	0.09	0.00	0.15	0.13	0.44	0.09
		Okaroro	NA	0.07	0.14	0.22	0.05	0.07
Tomtit	0.08	Motatau	0.90	0.85	0.44	0.55	1.00	0.81
		Okaroro	NA	0.14	0.17	0.28	0.41	0.23

Table 3. Number and outcome of kukupa nests located at Motatau, Northland, 1996–97 to 2000–01.

Season	No. nests located	No. (%) nests successful	No. (%) nests failed, due to: Ship rat	Possum	Unk. pred.	Deserted	Unk.	Harrier
1996–97	6	0 (0)	1	4	0	0	1	0
1997–98	11	1 (9)[1]	0	5	0	2	2	1
1998–99	7	7 (100)	0	0	0	0	0	0
1999–2000	4	1 (25)	0	0	1	2	0	0
2000–01	16	5 (31)	4	2	1	3	1	0
TOTAL	44	14 (32)	5 (11)	11 (25)	2 (5)	7 (16)	4 (9)	1 (2)

[1] The successful nest received the protection of trapping for possums at the nest tree in addition to station-based pest control.

October–January tracking rate 34%), but possum numbers remained low (7% trap-catch rate in October 2000; 3% in January 2001). Although we found the greatest number of nests (16) in that year, two-thirds (69%) of them failed, mostly at the egg or early chick stage and (according to remaining sign) due to ship rat predation.

Time-lapse video cameras filmed the conclusion of eight nesting attempts. Possums scared sitting females off three nests and ate the eggs; a ship rat ate one egg when the female did not return to incubate one night; one egg was dislodged from its nest during a storm event; two nests were abandoned after full-term incubation; and one fledged a kukupa after possum traps were set around the nest tree.

Discussion

The failure at the egg stage of all seven kukupa nests located at Motatau before pest control started echoes the complete failure of 20 nests at Wenderholm near Auckland during 1988–1990, and of nine nests at Mohi Bush, Hawke's Bay in 1988–1991 (Clout *et al.*, 1995). Fledging success at unprotected nests elsewhere on the mainland has also been poor: 22% of 45 nests at Pelorus Bridge, Marlborough (Clout *et al.*, 1995), and 19% of 31 nests near Whangarei (Pierce and Graham, 1995). For all these mainland sites, predation was implicated as the main cause of failure. In contrast, 63% of 16 nests found on the pest-free Chickens Islands succeeded to late fledging stage (Pierce and Graham, 1995).

We suggest ship rats are important kukupa egg predators rather than scavengers (James and Clout, 1996). At Motatau, kukupa females were absent for at least one night from three of five nests we filmed with eggs, which made access easy for predators. All three eggs were eaten, including one by a ship rat. Three filmed possum predation events at Motatau showed that possums easily displaced kukupa females, thereby gaining access to the egg. We did not film ship rats displacing kukupa (which weigh 650 g), but they can displace the smaller (230 g) kokako (Innes *et al.*, 1996; I. Flux, Dept. Conservation, Wellington, N.Z., and P. Bradfield, Dept. Conservation, Te Kuiti, N.Z., *unpubl.*), and they frequently eat adult robins (35 g), tomtits (11 g) and fantails (8 g) on nests [Brown, 1997; Mudge, 2002; bird weights from Heather and Robertson (1996)].

The few field seasons and nests monitored at Motatau preclude detailed statistical analysis of the relationship between possum and ship rat indices and kukupa nesting success. However, the Motatau data are consistent with a larger set of nesting success data for kokako (P. Bradfield *et al.*, *unpubl.*). Possums and ship rats are both important predators of kokako, operating either alone (e.g. kokako disappeared from Great Barrier Island which has ship rats but no possums) or together. Collated evidence from time-lapse video cameras (James, 1995; James and Clout, 1996; this study), sign remaining at nests (Clout *et al.*, 1995; Pierce and Graham, 1995; this study) and nest success rates under different pest abundance regimes suggest that ship rats and possums are both important predators at kukupa nests. Possums caused most nest failures at Motatau in 1996–97 (before pest control started) and again in 1997–98 until possums were greatly reduced. The only successful nest in the 1997–98 season (when few ship rats were present) required protection against possums by trapping around the nest tree. Conversely, the failure of most nests at Motatau in 2000–01, when rats were common but possums scarce, implicates rats.

We suggest that managers wishing to boost kukupa nesting success to near maximum levels must reduce possums to trap-catch rates below 5%, and ship rats to tracking rates below 5% for the duration of the breeding season, as for kokako. The targeting of possums and ship rats will also benefit kukupa by increasing overall forest health (Nugent *et al.*, 2002) and probably food abundance.

The cost of rat control could be reduced by targeting only the best breeding seasons. In good fruiting years, more kukupa attempt breeding and the breeding season is longer (Clout *et al.*, 1995; Mander *et al.*, 1998).

Pierce and Graham (1995) found that taraire and puriri (*Vitex lucens*) between them contributed to more than 75% of kukupa diet in winter (taraire), spring (both species) and summer (puriri) in their Northland study. At Motatau, 1999–2000 was a poor breeding season with few breeding attempts and a late (October) start, compared with the following 'good' season that started in July 2000. This correlates with poor fruiting of taraire in 1999–2000 compared with 2000–01 (unpub. data), so taraire fruiting could be used as a signal for rat control.

Counts of kukupa adults increased at Motatau, suggesting that the pest control there not only reduced predation rates but increased the population. Similar increases occurred in Te Urewera National Park (Jones, 2000) and Trounson Kauri Park (Coad, 2001) after similar pest control. Our study suggests that the increase was at least partially due to increased nest success. However, kukupa are highly mobile and some of the recruits may have immigrated to Motatau to exploit improved food sources. Marlborough kukupa travelled up to 18 km between forest areas for feeding and breeding (Clout *et al.*, 1991). We often saw kukupa flying into or away from Motatau Forest, and two radio-tracked birds were occasionally followed to other forests 5–6 km away. These observations suggest kukupa management is intrinsically large-scale, and that population restoration in small areas should increase kukupa numbers in surrounding forests also.

The contemporaneous decline and subsequent increase of ship rat tracking rates in the *non*-treatment block, 8 km away, was clearly coincidental. Rodent populations are dynamic, and similar declines have been measured in other non-poisoned populations (e.g. Innes *et al*., 1999). This result suggests that the Motatau decline after poisoning may have been partly due to other factors, but the first post-poison index at Motatau (0% tracking) was much lower than at Okaroro (16%).

Pest control may also have affected other bird species at Motatau (Table 2). Without replication or supporting evidence such as improved nest success, we cannot confidently attribute these changes to the pest control, but interestingly, grey warbler also declined after pest management in both Te Urewera National Park (Jones, 2000) and in Trounson Kauri Park (Coad, 2001).

Mander *et al.* (1998) considered whether 5-minute counts of kukupa were greatly affected by the proportion of birds attempting to nest in a particular year, as estimated from display flight monitoring. Our data suggest they may be, since 5-minute count numbers peaked at Motatau in late 1999 (Fig. 2a), when few females were nesting. The number of display flights counted varied greatly from week to week (Fig. 2b), but the gradual increase in the maximum count per season echoed the overall trend suggested by 5-minute counts. The number of display flights made is clearly influenced greatly by food supply from year to year as well as by abundance, as noted by Coad (2001).

Kukupa research ceased in 2002, but Ngati Hine, the Department of Conservation, surrounding landowners and Landcare Research continue to work together, not only to try to sustain the restoration gains already made but to expand the co-operative approach to a wider area. One key concern for ongoing cost-effective pest control at Motatau is the current lack of a widely usable and acceptable toxin that targets both rats and possums. Another major problem is the inevitable difficulty that iwi (and community) groups face in obtaining the funding needed to protect the native species in their neighbourhoods when the conservation values at risk do not rank highly in terms of national biodiversity.

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Appendix. Scientific names of birds mentioned in the text, after Turbott (1990).

Common name	**Scientific name**
Brown kiwi	*Apteryx australis*
Chaffinch	*Fringilla coelebs*
Dunnock	*Prunella modularis*
Eastern rosella	*Platycercus eximius*
Fantail	*Rhipidura fuliginosa*
Grey warbler	*Gerygone igata*
Harrier	*Circus approximans*
House sparrow	*Passer domesticus*
Kingfisher	*Halcyon sancta*
Kokako	*Callaeas cinerea wilsoni*
Kukupa	*Hemiphaga novaeseelandiae*
Myna	*Acridotheres tristis*
Pheasant	*Phasianus colchicus*
Robin	*Petroica australis*
Shining cuckoo	*Chrysococcyx lucidus*
Silvereye	*Zosterops lateralis*
Tomtit	*Petroica macrocephala*
Tui	*Prosthemadera novaeseelendiae*
Yellowhammer	*Emberiza citrinella*