

Direct observations of shining cuckoos (*Chrysococcyx lucidus*) parasitising and depredating grey warbler (*Gerygone igata*) nests

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Abstract The grey warbler (*Gerygone igata*) is the main host of the shining cuckoo (*Chrysococcyx lucidus*) in New Zealand. I describe 4 observations of egg-laying by shining cuckoos in the nests of grey warblers, and 2 observations of adult cuckoos evicting, or attempting to evict, nestling warblers from non-parasitised nests. Nests were parasitised from 0658 to 1731 h NZDT, and the cuckoos took 5–18 s to lay their egg. In 3 nests in which it could be determined, the cuckoo left the nest with an egg in its bill. Warblers were present at 2 nests during parasitism and responded by attacking the cuckoo. Cuckoos evicted nestlings by pulling them out through the nest entrance and throwing them on the ground. Head-wounds on evicted chicks suggest they were pecked. Nestling eviction by adult shining cuckoos has not been previously reported and it may be a strategy to increase nest availability by inducing hosts to relay.

Briskie, J.V. 2007. Direct observations of shining cuckoos (*Chrysococcyx lucidus*) parasitizing and depredating grey warbler (*Gerygone igata*) nests. *Notornis* 54(1): 15-19.

Keywords shining cuckoo; grey warbler; brood parasitism; nestling eviction; *Chrysococcyx lucidus*; *Gerygone igata*

INTRODUCTION

How parasitic cuckoos lay their eggs in host nests has long fascinated ornithologists. Well into the 20th century (e.g., Fulton 1909), it was even widely believed that cuckoos first laid their eggs on the ground and then carried them to their intended victim's nest. Subsequent observations and photographs have since dispelled this myth and show conclusively that cuckoos lay directly in the host nest (Chance 1940; Brooker *et al.* 1988).

To date there has been only one published account of egg-laying by the shining cuckoo (*Chrysococcyx lucidus*). Brooker *et al.* (1988) observed the Australian subspecies of the shining cuckoo (*C. l. plagosus*) parasitise a yellow-rumped thornbill (*Acanthiza chrysorrhoa*) nest in Western Australia. In this paper, I report 4 observations of shining cuckoos of the New Zealand subspecies (*C. l. lucidus*) parasitising nests of the grey warbler (*Gerygone igata*). I also report 2 observations of adult cuckoos evicting nestling warblers, perhaps in an attempt to force re-nesting and thereby provide further opportunities for parasitism.

METHODS

Study area

The study area was located at Kowhai Bush, a 240-ha area of native forest 10 km from Kaikoura, South Island. The avifauna of this area has been the subject of many studies (e.g., Powlesland 1981; Gill 1982),

and the site has been described in detail by Gill (1980). Parasitism rates of grey warblers by shining cuckoos at this site average 55-59% (Gill 1983; Briskie 2003). The grey warbler is the only regular host of the shining cuckoo in the main islands of New Zealand (Gill 1998). Its eggs are white with brownish spots, and so are readily distinguished from the olive green eggs of shining cuckoos (see image in Briskie 2003).

Video-monitoring of nests

As part of a larger study of life history traits in New Zealand native birds, I have monitored nests of a variety of forest passerines from 1998-2005. The monitoring involved visiting nests every few days to monitor their progress, and filming a subset of nests to obtain information on parental behaviour. Except for one act of parasitism witnessed in person, all other observations were recorded on video-tape. The observations reported in this paper are based on films made at 25 warbler nests. Each nest was filmed once only, either during the incubation period ($n = 17$ nests) or the nestling period ($n = 8$ nests). Sony Hi8® video-cameras were used to film nests. Cameras were set up shortly after dawn at 5–15 m from the nest, and I filmed each nest for 6 h. I revisited each nest to replace the tape after 3 h and to retrieve the camera after 6 h. No warblers appeared alarmed by the presence of the camera and all returned to normal behaviour, as judged from the video-taped record, within a few minutes after I left the area. My objective was to obtain information on parental behaviour, and not specifically on cuckoo



Fig. 1 Shining cuckoo (*Chrysococcyx lucidus*) perched on nest of a grey warbler (*Gerygone igata*) in which it has just laid an egg. Arrow indicates another cuckoo egg held in the cuckoo's bill as it leaves nest (the cuckoo's head faces down and to left; its tail points down and to bottom right). The warbler nest is hidden by fern fronds, but occupies middle area on left side. Image from video-tape of nest 1. Sketch on right indicates location and orientation of cuckoo holding egg in its bill.

parasitism, so the observations reported here were opportunistic. Video-tapes were later viewed on a Sony Video-Walkman®, and copies are available upon request. All times are reported as New Zealand Daylight Time (NZDT).

RESULTS

Observations of egg laying by cuckoos

Three of 17 grey warbler nests filmed during the incubation period were video-taped in the act of being parasitised by shining cuckoos. A 4th nest was directly observed being parasitised. These are described below.

Nest 1 When located on 12 Oct 2001, this nest held only a single warbler egg. By 19 Oct, 3 warbler eggs and a single shining cuckoo egg were present and the female warbler was incubating. On 23 Oct, the female was on the nest when I set up the camera (0647 h) and she did not leave the nest until 0658 h. A shining cuckoo landed on the nest 22 s later and entered the nest except for its tail, wing tips, and upper back. The cuckoo spent 18 s in the nest, then backed out, and flew off carrying what appeared, based on its colour and lack of spotting, to be a cuckoo egg (Fig. 1). The female warbler returned at 0705 h, but showed no response to the cuckoo's visit, and immediately continued to incubate. I checked the nest at the end of the session and found 3 warbler eggs and 1 cuckoo egg present. I did not realise a 2nd cuckoo egg had been laid that morning and the previous one removed until I viewed the video-tape later that day. When I checked the nest the next day, I candled the cuckoo egg and found no obvious development, confirming it had been laid recently. The cuckoo chick hatched ~8 d after

the 2 warbler chicks hatched, but it was too small to compete and disappeared a few days later. The warbler chicks fledged successfully.

Nest 2 Located on 4 Dec 2001, this nest was already parasitised and contained 2 warbler eggs and 1 shining cuckoo egg. The age of the nest was unknown but the female was incubating which suggests she had already finished laying when the nest was found. The nest was filmed starting at 0642 h on 6 Dec (Fig. 2A). At 0941 h, a shining cuckoo arrived and entered head first, leaving its tail, upper back, and wing tips protruding from the entrance hole (Fig. 2B). A grey warbler, flapping its wings and pecking the cuckoo, perched on the back of the cuckoo as it landed, and remained there for 2 s before flying off and hovering within 100 mm of the cuckoo (Fig. 2C). A brown creeper (*Mohoua novaeseelandiae*) also approached the nest to within 300–400 mm and gave an alarm call but did not attack the cuckoo. The cuckoo backed out of the nest 8 s later, and flew off with a warbler egg in its bill. The warbler visited the nest at 0948 h and examined the contents but then flew off. The warbler made 4 additional visits during the next 20 min, briefly inspecting the nest each time. At 1009 h, the female warbler entered the nest and began incubation. When checked at the end of filming, the nest contained 2 cuckoo eggs and 1 warbler egg. The nest was depredated a few days later.

Nest 3 I observed this nest as it was parasitized. On 11 Dec 2001, I was attracted to the alarm calls of a grey warbler. When I arrived, 2 warblers were chasing a shining cuckoo in circles of 20–40 m around their nest. After 2–3 min, the cuckoo flew toward the nest tree but flew away a few seconds later. I moved to within 2 m of the nest, and the cuckoo then landed

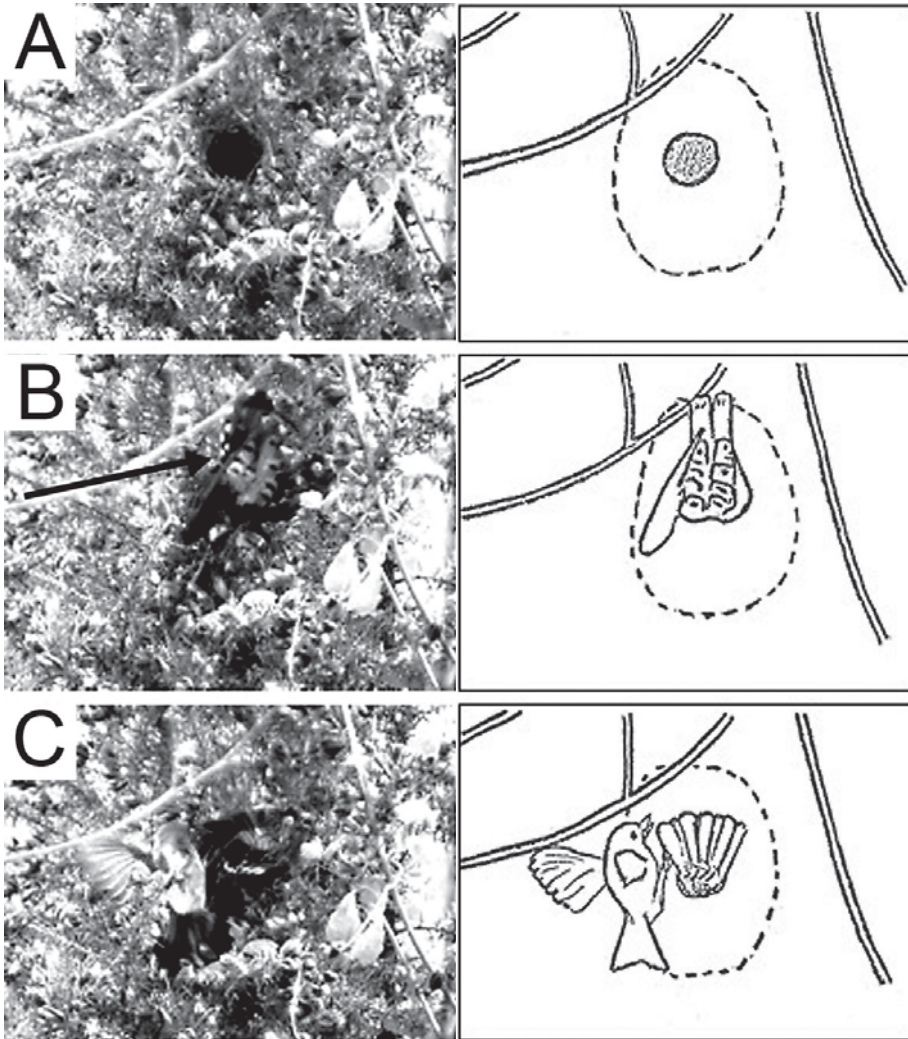


Fig. 2 Nest defence by grey warbler (*Gerygone igata*) against shining cuckoo (*Chrysococcyx lucidus*). (A) 0642 h: Warbler nest unoccupied; nest entrance visible in centre of image. (B) 0941 h: Cuckoo enters head-first with only black and white barring of underside of tail visible (arrow). (C) A few seconds later an adult warbler hovers to left of nest and attacks cuckoo. Images from video-tape of nest 2. Sketches on right indicate location and orientation of nest, shining cuckoo, and grey warbler.

on the nest and entered. The cuckoo remained in the nest for ~5 s while the warblers pecked its tail and back. None of the birds seemed alarmed by my very close presence. After the cuckoo flew away, a warbler returned to the nest briefly. I inspected the nest and found 2 grey warbler eggs and 1 shining cuckoo egg. I did not know the nest contents before this, but the warbler eggs were cool while the cuckoo egg was warm, suggesting the latter had just been laid. The time of laying was 1731 h, or about 4 h before sunset. I could not tell if the cuckoo removed a warbler egg as it flew away as it moved too fast.

When I visited a few days later, the nest had been depredated.

Nest 4 I filmed this nest on 27 Oct 2004. The nest was too high to inspect so it is not known how many eggs were present, nor if it had been parasitised previously. However, the female had been incubating at least 5 days before filming. At 1059 h a cuckoo landed on the rim of the nest, reached in, and pulled the adult warbler out. Both the cuckoo and warbler then flew out of camera view. Four seconds later, a cuckoo returned and entered the nest. The cuckoo left 8 s later, holding a warbler egg in its

bill. A slight thrust and trembling movement by the cuckoo while in the nest suggested that an egg may have been laid. While in the nest, a grey warbler attacked by pecking at the cuckoo's exposed tail and back. After the cuckoo left, a warbler visited the nest twice in the next minute, with each visit being a brief inspection of the nest. The female warbler resumed normal incubation at 1106 h. Because the nest was too high to permit inspection, I could not be certain that the nest was parasitised. However, the nest was later depredated, and I found part of a shining cuckoo egg-shell under the nest, suggesting that the nest had been parasitised at some time.

Eviction of warbler nestlings by adult cuckoos

Shining cuckoos were observed evicting nestling grey warblers at 2 of 8 nests filmed during the nestling period. These are described in detail below.

Nest 5 I filmed this nest on 13 Dec 2002. On the day of filming it contained 2 chicks c. 10 days old. At this stage chicks weigh about 6.4 g. At 1005 h, a shining cuckoo arrived and put its head into the nest. It was chased away by the warblers within a few seconds. Ninety seconds later a cuckoo returned to the nest, and again reached into the nest. This time it pulled out 1 warbler chick so that it was resting on the nest entrance. The cuckoo was again chased off and an adult warbler returned 10 s later and inspected the nest. Five more visits were made by the adult warbler(s) over the next 3 min. At no point did the adult warbler try to push the half-evicted nestling back into the nest, and on 1 visit it even stood on the nestling to feed the other chick in the nest. Finally at 1010 h, the half-evicted nestling pulled itself back into the nest. Feeding by the adults continued normally until the end of filming. However, the next morning both nestlings were dead under the nest. Both had been pecked in the head, but otherwise showed no sign of predation and the nest was not damaged. As the nestlings were cold and covered with heavy dew, it is likely they had been killed the previous day.

Nest 6 This nest was filmed on 20 Nov 2004. It contained 2 nestlings at the same age as in nest 5. At 0937 h, a shining cuckoo landed on the nest, and pulled both chicks out by reaching in and grabbing them with its bill. The chicks were pulled out 1 at a time and dropped under the nest. The cuckoo left after taking only 9 s to remove both warbler chicks. An adult warbler arrived back a minute later and looked inside. Repeated visits were made by both adult warblers over the next few hours. As the evicted chicks were out of camera view, it is unknown if the adults fed the nestlings on the ground. When the camera was retrieved, the area was not checked and I did not know what happened until the tape was viewed later that day. However, when checked the next morning, both chicks were dead on the ground

under the nest, and had peck marks to the head. The corpses were wet with dew and there were no other signs of predation, suggesting they died the day before and had been killed by the cuckoo.

DISCUSSION

As observed previously in Western Australia (Brooker *et al.* 1988), shining cuckoos in New Zealand enter the domed nests of their hosts to lay eggs. All cuckoos entered the nest head-first, and were able to fit their entire body in the nest except for the tail, posterior part of the upper back, and wing tips. They exited the nest by backing out tail-first. The cuckoo did not appear to damage the nest in the process.

The total time spent by shining cuckoos in the nest varied from only ~5–18 s. This is similar to that observed in Australia (18 s; Brooker *et al.* 1988), and similar to that found in other species (e.g., European Cuckoo, *Cuculus canorus*: 4–16 s; Seel 1973; Wyllie 1975) although Moksnes *et al.* (2000) recorded stays of up to 158 s for the European cuckoo. It is interesting that the longest time (18 s) spent in a nest by a cuckoo in my study was at a warbler nest in which the hosts were absent. At 3 nests where warblers were present, and attacked the cuckoo, the time the cuckoos spent at the nest decreased to ~5–8 s. In at least 2 instances, cuckoos laid an egg despite the shorter time and the aggression by the host. Other authors have suggested the short laying times of parasitic birds likely evolved to avoid aggression by hosts (Davies & Brooke 1988). My observations of short laying times at nests with host aggression are consistent with this hypothesis, although aggression did not prevent cuckoos from laying.

Until these observations, it was not known at what time of the day that shining cuckoos laid their eggs in New Zealand, although both Horsfield's bronze-cuckoo (*C. basalis*) and the shining cuckoo in Australia have been observed laying in the early morning (Brooker *et al.* 1988). In contrast, European cuckoos generally lay their eggs in the afternoon (Chance 1940; Wyllie 1975). My observations indicate that the timing of laying in shining cuckoos is flexible and that laying can occur throughout the day. Laying was recorded from 0658 h (c. 30 min after sunrise) to 1731 h (a few hours before sunset). As filming took place only during the 1st 6 h of morning, it is likely I missed other acts of parasitism at other times of the day, and further work is needed to determine when shining cuckoos are most likely to lay.

As with other brood parasites, shining cuckoos remove at least 1 host egg from the nest. In the 3 instances in which I could see the bird leave the nest, all carried an egg. Once, a shining cuckoo egg that had been laid at least 4 d earlier was removed. Although I could not see what cuckoos were doing in the nest, it appeared they first reached in the

nest to pick up an egg, and then later "pulled" their lower abdomen deeper into the nest to lay. This sequence would preclude the possibility of its removing its own egg if it removed an egg only after having itself laid. I did not observe what cuckoos did with host eggs, but they may have eaten them. Shining cuckoos on my study site have also been filmed visiting nests of redpolls (*Carduelis flammea*) and chaffinches (*Fringilla coelebs*) to remove and eat eggs (*pers. obs.*). None of these nests was parasitised, which suggests that eggs are a regular part of the cuckoo diet. Other observers (e.g., Skinner 1986; MacDonald and Gill 1991) have also seen shining cuckoos eating eggs.

Grey warblers are an "accepter" species (Rothstein 1975; Briskie 2003). They do not reject parasitic eggs, and instead raise the foreign young as their own. As the enclosed nests of warblers are quite dark inside, it is possible they cannot see parasitic eggs and accept a cuckoo egg for this reason. However, my observations show that warblers are sometimes present when their nests are parasitised (in 1 instance the female warbler was pulled out of her nest by the cuckoo), and that they act aggressively towards the cuckoo. Thus, there should be little doubt that they have been parasitised. Nevertheless there was no sign of either their rejecting cuckoo eggs or deserting any nest I observed. As shining cuckoo parasitism of grey warbler nests generally leads to the total loss of the host young (Gill 1983), it is not clear why warblers persist with a nesting attempt, even after witnessing the act of parasitism.

The eviction of host young has been observed in other brood parasites (Elliot 1999; Granfors *et al.* 2001), and my observations indicate adult shining cuckoos do so as well. By killing host young in non-parasitised nests, a cuckoo could increase its pool of future nests to parasitise if infanticide leads to re-nesting by the hosts (Elliot 1999). In the instances I observed, nestlings were attacked late in the breeding season and there would have been little opportunity for the warblers to have re-nested (Gill 1983). However, on 3 other occasions I found warbler nests near the start of the breeding season in which all chicks were dead, either in or under the nest. These young had peck marks to the head, similar to those observed in this study, which suggests that they could have been killed by cuckoos. Such infanticide early in the season could lead to the hosts' re-nesting, and so allow a cuckoo to exploit hosts in its territory that it had otherwise missed parasitising.

ACKNOWLEDGEMENTS

I thank Kathryn Atkinson, Craig Barnett, Nicola Congdon, Sacha Dowell, Rodney Garrard, Katrina Hale, Ole Jacobsen,

Rachel Johnson, Emily King, Myles Mackintosh, Craig Morley, Lisa Shorey, Andrew Thomas, Andrew Ward, Elinor Watson, Belinda Whyte, and Kerryn Wratt for help in finding and monitoring nests. The Canterbury Regional Council allowed me to work at Kowhai Bush. I also thank Tom E. Martin for his support of my studies on life history evolution in New Zealand birds, and Jack van Berkel for the use of facilities at Edward Percival Field Station. Brian Gill and Gary Ritchison provided comments on an earlier draft of this paper. Funding was provided by a grant from the Brian Mason Scientific Trust and the University of Canterbury. My work was approved by the Animal Ethics Committee of the University of Canterbury.

LITERATURE CITED

- Briskie, J.V. 2003. Frequency of egg rejection by potential hosts of the New Zealand cuckoos. *Condor* 105: 719-727.
- Brooker, M.G.; Brooker, L.C.; Rowley, I. 1988. Egg deposition by the bronze-cuckoos *Chrysococcyx basalis* and *Ch. lucidus*. *Emu* 88: 107-109.
- Chance, E.P. 1940. *The truth about the cuckoo*. London, Country Life.
- Davies, N.B.; Brooke, M. de L. 1988. Cuckoos versus reed warblers: adaptations and counteradaptations. *Animal behaviour* 36: 262-284.
- Elliot, P.F. 1999. Killing of host nestlings by the brown-headed cowbird. *Journal of field ornithology* 70: 55-57.
- Fulton, R. 1909. The pipiwharau, or bronze cuckoo (*Chalcococcyx lucidus*), and an account of its habits. *Transactions of the New Zealand Institute* 42: 392-408.
- Gill, B.J. 1980. Abundance, feeding and morphology of passerine birds at Kowhai Bush, Kaikoura, New Zealand. *New Zealand journal of zoology* 7: 235-246.
- Gill, B.J. 1982. Breeding of the grey warbler *Gerygone igata* at Kaikoura, New Zealand. *Ibis* 124: 123-147.
- Gill, B.J. 1983. Brood-parasitism by the shining cuckoo *Chrysococcyx lucidus* at Kaikoura, New Zealand. *Ibis* 125: 40-55.
- Gill, B.J. 1998. Behavior and ecology of the shining cuckoo *Chrysococcyx lucidus*. pp. 143-151. In: Rothstein, S.I.; Robinson, S.K. (ed.) *Parasitic birds and their hosts: studies in coevolution*. New York, Oxford University Press.
- Granfors, D.A.; Pietz, P.J.; Joyal, L.A. 2001. Frequency of egg and nestling destruction by female brown-headed cowbirds at grassland nests. *Auk* 118: 765-769.
- MacDonald, C.; Gill, B.J. 1991. Shining cuckoo eating an egg. *Notornis* 38: 250-251.
- Moksnes, A.; Røskaft, E.; Hagen, L.G.; Honza, M.; Mørk, C.; Olsen, P.H. 2000. Common cuckoo *Cuculus canorus* and host behaviour at reed warbler *Acrocephalus scirpaceus* nests. *Ibis* 142: 247-258.
- Powlesland, R.G. 1981. The foraging behaviour of the South Island robin. *Notornis* 28: 89-102.
- Rothstein, S.I. 1975. An experimental and teleonomic investigation of avian brood parasitism. *Condor* 77: 250-271.
- Seel, D.C. 1973. Egg-laying in the cuckoo. *British birds* 66: 528-535.
- Skinner, J.F. 1986. Shining cuckoo carrying an egg. *Notornis* 33: 188.
- Wyllie, I. 1975. Study of cuckoos and reed warblers. *British birds* 68: 369-378.