Further evidence of female incubation and family grouping in Brown Kiwis

Anecdotal observations suggest that the Stewart Island Brown Kiwi (*Apteryx australis lawryi*) differs in its breeding behaviour from the strictly monogamous, male-only incubation strategy of the North Island Brown Kiwi (*A. a. mantelli*) (Robson 1947). An early collector on Stewart Island, Mr Marklund, found five kiwis inhabiting an extensive burrow chamber (Buller 1897), and in 1911 Guthrie-Smith (1914) found a 'lodge' of several birds. Falla (1979) suggested the possibility of polyandry after noting a pair sharing a burrow with an extra male waiting outside. Soper (1976) found a female Stewart Island Brown Kiwi with a chick in a nest at night and recently Sturmer & Grant (1988) observed a female sitting on an egg in a burrow during the daytime.

In February 1988 I began a study of the breeding behaviour of 10 pairs of Stewart Island Brown Kiwi at Mason Bay. Results from five field trips have confirmed that both the male and female of a pair incubate to the extent that both sexes (all males, 6 of 10 females) develop well-defined brood patches. Females were observed sitting tightly on eggs. Change-over times at the nest are similar to those of the Great Spotted Kiwi (*A. haastii*) in that females usually relieve the males in the second hour of darkness and remain there overnight until their mates return, often just before dawn (McLennan & McCann 1989). Females occasionally join males at nests and sometimes incubate during the day. At one nest I observed a female brooding a recently hatched chick while the male was incubating a second egg.

Females of other Brown Kiwi populations incubate also. In July 1990 at Okarito, I saw both members of a pair of South Island Brown Kiwi (*A. a. australis*) in the nest taking turns incubating by day. Female Brown Kiwis may also incubate on Kapiti Island. This population originated from introductions, in 1908, of a pair from Dusky Sound and, in 1912, of five birds from Jackson Bay. I caught a female on Kapiti Island showing very heavy moulting over its belly, which may have been a brood patch. Thus, incubation by female Brown Kiwis is not aberrant behaviour but the norm among kiwis in the South and Stewart Islands. Incubation by both sexes may be a response to overcoming possibly more extreme chilling of the egg in the colder mean temperatures of the South and Stewart Islands. Incubation by both sexes may also reduce the incubation period of the egg, thereby reducing the risk of climatic disasters, such as flooding and snow drifts.

Female Stewart Island Brown Kiwis that were incubating all night regularly foraged by day, as did some males when their eggs had hatched. At the same time those adult birds that had failed to breed remained in their shelter burrows by day. South Island Brown Kiwis in Takahe Valley, Fiordland, have been seen foraging during the late afternoon (D. Newman, pers. comm.). It would be interesting to know whether incubating females of the Great Spotted Kiwi also forage during the day.

Juveniles of the North Island Brown Kiwi have been recorded sharing the nest with the male for up to 20 days, after which they were not seen with their parents (McLennan 1988). At Waitangi State Forest, Northland, I caught a young bird estimated to be about 9 months old, feeding with an

adult pair, but birds caught older than this were always on their own. In contrast, Stewart Island Brown Kiwi parents were associated with their offspring for much longer. During one field trip to Mason Bay I found five chicks 1-4 months old in burrows with their parents. Nine months later these chicks were still occupying nests with their parents, who were by then incubating new eggs. Other observations at Mason Bay include one 2-year-old male that was found brooding its parents' recently hatched chick; a male, banded when it was 1-year old, discovered sharing its parents' shelter burrows and nest 3 years later; and two females, each at least 6 years old, that shared burrows and a nest together with a male. With the last example the egg was buried in the bottom of the nest and both females had brood patches. Blood samples were taken from each of the females to determine their relationship to each other, but these have not yet been analysed. On Kapiti Island I saw a group of three Brown Kiwis, one of which was at least a year old, feeding together.

Nine of the 10 pairs of kiwi studied at Mason Bay were associated with at least one more adult-sized bird. The largest groups comprised up to seven individuals, including one or two chicks. These groups occupied territories, defending the boundaries fiercely when members of neighbouring groups encroached. Such territorial behaviour was observed at Mason Bay homestead, where a chick, which had been rescued from a gin trap and taken to the homestead, was attacked and killed by a local adult when it accidentally wandered out of its pen (T. Te Aika, pers. comm.).

Three of the findings described above are completely new for kiwis: (1) that some birds live in groups and apparently help each other to breed and defend a territory, (2) that some females develop a brood patch, and (3) that incubating females spend more time feeding during daylight than do their non-breeding counterparts. Studies are continuing on Stewart Island into the genetic relationships between group members, the role of helpers in incubation and territorial defence, the survival and movements of juveniles, and the reasons why the birds there have such a different social system from those in the North Island.

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