Notes on the nesting and breeding behaviour of the Grey-crested Helmet-shrike *Prionops poliolophus* around Lake Naivasha, Kenya

The Grey-crested Helmet-shrike *Prionops poliolophus* is a social and cooperatively breeding species. It is an uncommon East African endemic (Lewis & Pomeroy, 1989), restricted to the savannah woodlands of Serengeti-Mara ecosystem of southern Kenya and northern Tanzania, one of the world's Endemic Bird Areas (Stattersfield *et al.* 1998). It is listed as Near-threatened in the IUCN Red List as evaluated by Birdlife International (Birdlife International 2008). In spite of this interesting social and cooperative behaviour in which all members of a group, including juveniles, help with breeding activities, little is known about their basic breeding biology. Basic information such as incubation and nestling periods is still lacking.

The breeding activities of 12 groups of the Grey-crested Helmet-shrike were recorded between September 2003 and March 2004 around Lake Naivasha, Kenya, 36° 21'E 0° 46'S. Sixteen nests were located built by eight of the 12 groups (Table 1). Nests were found between September and December. At the onset, only 2 to 3 individuals (perhaps the dominant members) engaged in the nest building activities, with the rest of the group joining afterwards. During the nest building period, the birds were very conspicuous and vocal, making distinct calls around the nest site. Typically, when not distracted, they returned to the same spot repeatedly to collect nesting materials, often using the same route back to the nest. Nest building and lining continued during the incubation period up until the first hatching. Each individual coming in for their incubation shift brought cobwebs and fixed the nest to keep it firm.

Although there were several tree species available in the study area, nests were exclusively placed in two tree species: *Acacia xanthophloea* and *Tarconanthus camphoratus*, perhaps due to their better cover for nest concealment. The nest consists of a supporting framework on a horizontal forked branch, and is about 35-50 mm in diameter and 14 mm in depth. It has the shape of an open cup with courser material (such as *T. camphoratus* bark) used for the framework and finer materials (cobwebs) lining the inside. The nest cup is plastered to a smooth finish with cobweb. The outer wall of the nest is entirely covered with cobweb, which is also used to bind the nest to the branch. The height of the nest above the ground varied with habitat and site; nests were typically between 3 and 5 metres high in *T. camphoratus* bushland, going up to 18 to 20 metres in *A. xanthophloea* woodland.

Table 1. Grey-crested Helmet-shrike breeding attempts and fate around Lake Naivasha during the study period. Different groups have distinct names which include numbers (which denote different groups in the same general area), whereas re-nesting attempts are denoted with capital letters A, B, C or D.

Nest no	Nest code	Date found	State found	Fate	Nature of Predation
1	Lion1_A	25-Sep-03	Nest building	Predated	Egg
2	Lion1_B	20-Oct-03	Nest building	Successful	Successful
3	Lion2_A	25-Sept-03	Nest building	Predated	Egg
4	Lion2_B	6-Oct-03	Nest building	Predated	Egg
5	Lion2_C	10-Oct-03	Nest building	Predated	Egg
6	Lion2_D	5-Nov-03	Nest building	Predated	Egg
7	Lodge	15-Oct-03	Incubation	Successful	Successful
8	Lodge2	22-Dec-03	Incubation	Successful	Successful
9	Mundui	14-Oct-03	Nest building	Successful	Successful
10	Nyati_A	19-Sep-03	Nest building	Predated	Egg
11	Nyati_B	20-Oct-03	Nest building	Predated	Egg
12	Nyati_C	12-Nov-03	Nest building	Predated	Egg & Nestling
13	Nyati_D	17-Nov-03	Nest building	Predated	Nest disturbed
14	Power1	10-Sep-03	Nest building	Predated	Nestling
15	Power2_A	24-Sep-03	Nest building	Predated	Egg & Nestling
16	Power2_B	20-Oct-03	Nest building	Predated	Egg

The egg is oval in shape, with a pale blue background and reddish brown streaks concentrated at the blunt end, almost forming a ring. Grey-crested Helmet-shrikes usually lay a clutch of 3-4 eggs; a maximum of seven eggs was recorded in this study. It is very likely that they lay two clutches in one nest. This was deduced from one of the groups where the number of eggs increased from 0 to 7 within four days, with the eggs showing slight variation in size. Thus, it was possible that more than one female was laying the eggs, since eggs were typically laid at intervals of 1-2 days (Malaki 2004).

Incubation period ranged from 16 to 18 days (n = 4) with an average of 17 days (Table 2). Incubation was shared among all members in the group including the juveniles, at intervals ranging between 30 and 120 minutes. Similar cooperative behaviour was observed during the nestling period, with the group members visiting the nest at intervals, either to feed or brood the nestlings. While doing so, they drew attention to themselves and to the rest of the group by calling frequently. The bird taking over the shift was often escorted towards the nest by the rest of the group. However, not all group members reached the nest, most stayed at a distance of about 10-30 m away and only the one taking over going to the nest. Nest visits became more frequent towards the end of the incubation period and nest was never left unattended for more than 2 hours.

Group size	Incubation period (days)	Nestling period (days)
4	18	24
4	18	24
6	17	22
17	16	22

Table 2. The group size, incubation and nestling periods of four different groups of the Grey-crested Helmet-shrike around Lake Naivasha.

Sixteen nests were located in total, of which one was disturbed before any eggs were laid; eight were predated during egg stage, two had some eggs predated but continued to incubate till the rest hatched but both were then depredated, one was predated during the nestling stage and four successfully fledged (Table 1). Re-nesting was observed after predation incidences, with four out of the eight groups observed having two or more nesting attempts after nest disturbance or egg/nestling predation (Table 1). None of the groups re-nested on the same tree after predation, always moving some distance away from the original tree. Up to four re-nesting attempts were observed for a single group (see Lion2 and Nyati groups in Table 1). For these groups, after the fourth attempt, the birds were never observed nesting during the period of this study. However, in one other group (Lion1) where re-nesting was observed, the second attempt was successful.

Once the chicks hatched, all members of the group took turns to feed and brood the nestlings; typically, the last to feed was left at the nest to brood. As with the incubation, the birds drew attention to themselves during nest change-overs. The size of the food brought to the nest varied with species and type; common prey was insect larvae, grasshoppers and praying mantis. The size of food given to the nestlings remained largely constant throughout the fledging stage, with only the frequency of nest visits increasing as the chicks grew older. Visits were typically made every 10-15 minutes and always involved the entire group, including the juveniles. The nestling period measured as the time between hatching of the last chick to when the last chick left the nest, was recorded for only four nests and averaged 23 days (Table 2).

The Grey-crested Helmet-shrikes seemed selective because they nested in specific trees within these habitats. In a broader study (Malaki 2004), several vegetation structure variables were measured and compared in nest and non-nest sites e.g. canopy cover, bush cover and canopy height amongst others. Significantly higher values (indicating greater foliage density and higher canopy cover) were found in sites selected for nesting compared to those without nests (Malaki 2004). Indeed, vegetation structure is a dominant factor in habitat selection by birds (Karr & Freemark 1983, Muchai 2002). For instance, higher foliage density is thought to improve nesting success by providing better concealment, inhibiting predator search, or hindering nest discovery through impeding transmission of chemical, visual and auditory cues (Krams 2000). Selection for greater foliage cover may also be associated with an enhanced thermal environment of nest microhabitat (Walsenberg

1985), leading to reduced likelihood of heat and cold stresses, thereby enhancing nest success.

Although based on a fairly small sample size, it is notable that chicks in the larger groups had slightly shorter nestling period, while chicks in the smallest group had the longest nestling periods (Table 2). This could suggest that more helpers in a group may accelerate chick growth by providing extra food. However, the effect on the nestling period is not unequivocal because the group of six seemed to negate this, fledged within the same period as the group of 17. It is possible that the positive helper-effect might have a threshold beyond which chick growth reaches its physiological ceiling and cannot be accelerated further. Still, additional helpers may indeed help the (focal) breeding pair (by reducing the time they spend incubating, as well as the effort they need to exert to feed the nestlings). This is likely to positively impact on their fitness and survival in the long-term, even without having a significant impact on chick growth per se together with factors governing habitat (and tree) selection, this fascinating group behaviour and potentional ramifications on individual survival and fitness are fertile grounds for long-term research.

Acknowledgements

We wish to thank Lord and Mrs Enniskelin and Mr. P. Swagger for kindly allowing us access to Mundui and Kongoni Farms respectively. The management of Kongoni Game Sanctuary for their cooperation is acknowledged. Thanks to Dr. and Mrs. Geffrey Irvine for their assistance while in Naivasha. Mr. and Mrs. Shell Harrison provided accommodation. Richard Waweru and Albert Chesoli helped with data collection. This study was funded by SIDA-SAREC though Research Program on Utilization of Dry Land Biodiversity (RPSUD).

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Scopus 28: 41-45, December 2008
Received April 2007