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Changes in the number of cooperative breeding groups of Yellow-billed Shrike *Corvinella corvina* at the University of Ghana, Legon, over 34 years

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Summary

The number of groups of the Yellow-billed Shrike *Corvinella corvina* and the total number of shrikes on the campus of the University of Ghana at Legon were determined in 2004 and compared with similar data obtained in the 1970s. Both had increased despite the general degradation of the campus due to major building programmes and a tenfold increase in student numbers. Breeding data indicate that number of clutches laid has been unaffected by the changes in the environment and infrastructure of the campus, but whether the breeding success of individual groups or of the population has changed since the 1970s remains to be studied.

Résumé

Les changements du nombre de groupes de reproduction en coopération de la Corvinelle à bec jaune *Corvinella corvina* à l'Université du Ghana à Legon pendant 34 ans. Le nombre de groupes de Corvinelle à bec jaune *Corvinella corvina* et le nombre total de Corvinelles ont été déterminés en 2004 et comparés avec des données similaires obtenues dans les années 70. Tous deux avaient augmenté malgré la dégradation générale du campus avec ses importantes constructions et un décuplement du nombre d'étudiants. Les données de la reproduction indiquent que le nombre de pontes n'a pas été affecté par les modifications de l'environnement et de l'infrastructure du campus; mais que le succès de la reproduction des groupes individuels ou de la population ait changé depuis les années 70, reste à étudier.

Introduction

The group behaviour and breeding biology of the Yellow-billed Shrike *Corvinella corvina* was studied on the campus of the University of Ghana for five years from 1970

(Grimes 1980). Each group then consisted of *c*. 12 individuals (range 6–25), which took part (in varying degrees) in the defence of the group territory, in feeding the breeding female at the nest-building stage and while she incubated and brooded young, and in the care of fledglings. The average group territory was 16.6 ha (range 10.6–27.1) and the population density was 0.8 birds per ha. The sex ratio (female/male) in a group was not constant and in one group during a three-year period varied between 5/3 and 4/9. Shrikes sometimes moved between groups, over distances up to 2000 m. Clutches were recorded in all months except Oct, though most were laid Jan–Aug. Up to three broods were raised by some groups during a breeding season and the clutch following a successful breeding was laid while fledglings were being cared for by other group members. Groups usually have one breeding female but a second female may compete for breeding status either during a breeding season or at the beginning of a season.

Twenty-three groups were present at the start of the study and two new groups (Groups 24 and 25, Fig. 1) formed early in 1974 in areas not previously occupied by the shrike. Apart from Groups 2, 13 and 15 (Fig. 1), little or no detectable change occurred in either the territorial areas of the other groups or their boundary locations.

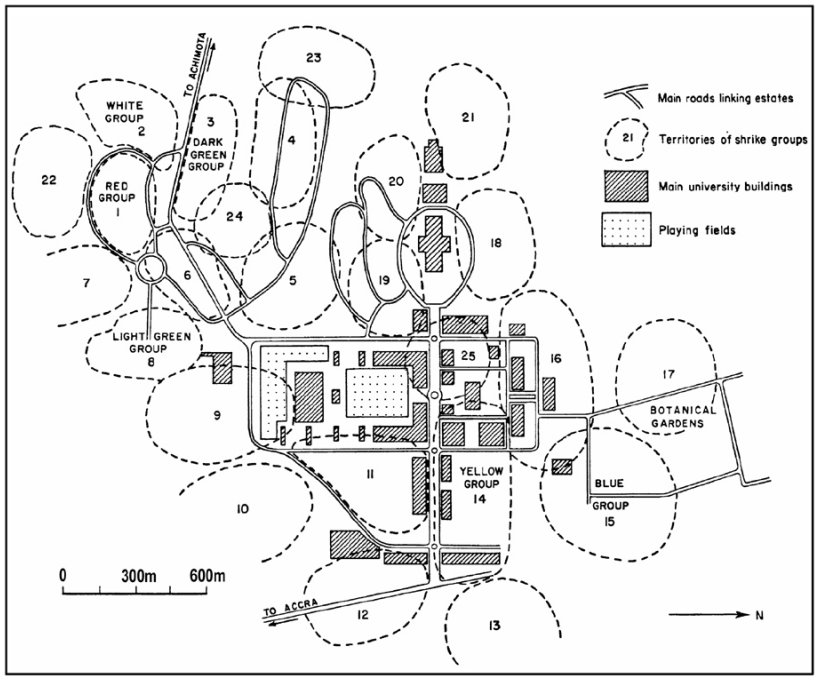

Figure 1. The distribution of group territories of the Yellow-billed Shrike on the campus of the University of Ghana at Legon in 1975 (after Grimes 1980).

After trees were cut down during the "Operation Feed Yourself" government programme in the early 1970s, Group 2 annexed part of the territory of Group 3, Group 13 part of the territory of Group 14, and Group 15 part of that of Group 16.

I had the opportunity to return 30 years later, and surveyed the location and number of shrike groups on the campus from late January 2004 for three months. In addition, the breeding activities and numerical strengths of most of the groups were recorded.

Methods

The number of groups and their locations were obtained by systematically surveying the campus, usually during the first and last 2 h of daylight but also at other times as opportunity arose. The existence of a group was considered proven if territorial disputes with neighbouring groups took place or if eggs, nestlings or fledglings were found. Nests were readily located through the characteristic calls, audible at distances up to 100 m, given at the nest by the breeding female during all stages of a breeding

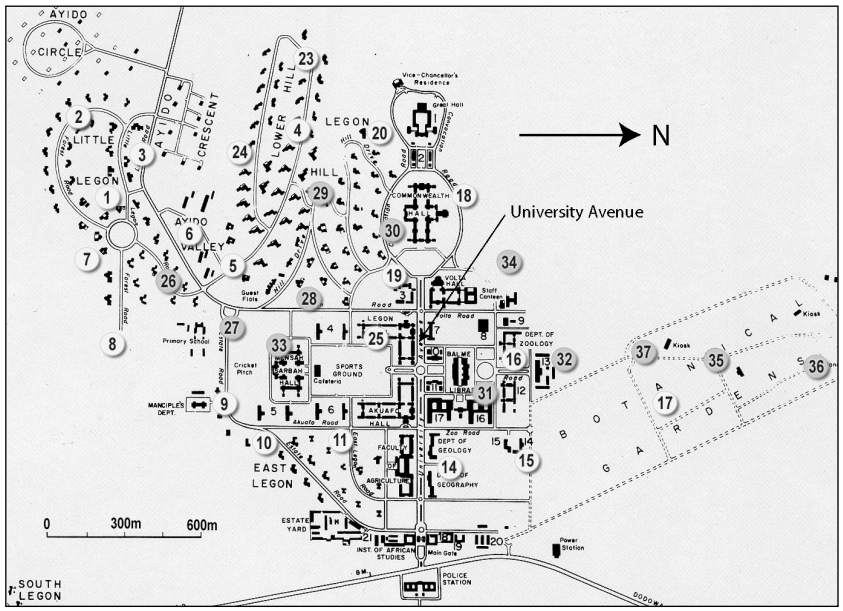

Figure 2. Yellow-billed Shrike groups on the campus of the University of Ghana in 2004. Those in white circles coincide with groups found in the 1970s and are numbered as in Fig. 1. The buildings shown are those present in 1993 but many others have since been constructed (see text).

cycle (nest building, incubation and brooding) and by other group members when visiting the nest (Grimes 1980). As a result most, if not all, groups and their nests on the campus were located during my stay. When not directly observed, the date of completion of a clutch was estimated using either the hatching date or the date when young left the nest. The number of shrikes in a group was counted either during territorial disputes or during playback of territorial calls when they invariably, but not always, clumped together and sought the source of the calls. Some group sizes were obtained as members either entered or left their communal roost.

Environmental changes

The residential areas of Little Legon, Legon Hill, Lower Hill, East Legon and Ayido Valley had changed little since the 1970s but since 1993 further residential areas, not shown in Fig. 2, have been built south of Little Legon. Open grassland existed between most of the houses, though some areas, *e.g.* between Ayido Crescent and Ayido Valley, were covered with thicket, mainly Neem *Azadirachta indica* saplings, and shrikes no longer occurred there. Most gardens had a scattering of shrubs and or trees and those on the periphery of the campus had small plantations of cassava and clumps of banana and paw-paw trees. All roads were lined with trees originally planted in the 1950s, and these were more than twice their 1970s height and their canopies were often continuous.

Since 1993, other student residences have been built on land south of the main campus and between East Legon and South Legon, and several faculties have had extra buildings erected mainly on the north side of University Avenue, which runs from east to west and bisects the main campus (Fig. 2). Several new buildings were under construction when I arrived. During my stay extensions to the Balme Library were started and plans for a new Physics laboratory were well advanced. Thus in the last decade up to 20 ha of ground have been cleared of vegetation formerly consisting mainly of grass and thicket with scattered trees.

The factor that has had the most effect on the environment has been the increase in student numbers, particularly in the last decade. Numbers totalled 2360 in 1971–2 and the average rate of increase was just under 90 per year during that decade. It then averaged 200 per year in the 1980s, 1000 per year in the 1990s, and > 4000 per year in 2002 and 2003. The student population at the beginning of the 2004 academic year was 24,876. In addition, the increase in noise level due to the extra traffic and student numbers (5–6 to a room compared with a maximum of two in the early 1990s) was marked.

The number of vehicles on the campus increased in step with student numbers and a continuous flow of traffic occurred throughout the day on most of the campus roads, especially those connecting faculties and student residences (Fig. 2). Cars were parked under any convenient shade tree, some of which were used unsuccessfully as nest

sites by the shrike. A thriving market with additional public transport facilities covered the 1970s territories of Groups 12 and 13, and these were no longer suitable for shrikes.

Tracks that provided short cuts between lecture rooms and accommodation blocks, criss-crossed the campus everywhere and the grass cover in the central campus was minimal, particularly on the north side of University Avenue. In addition, most areas between the annexes were bare of grass due to their overuse as football pitches. Plastic bag and bottle litter did not exist in the 1970s but was now a major concern. In addition, food stalls, which provided an alternative food supply to that supplied by residential halls, were set up each day and contributed to the general pollution.

Results

In spite of the environmental degradation of the central section of the campus, the Yellow-billed Shrike was widespread throughout (Fig. 2). Of the 33 groups located, the positions of 21 (Groups 1–11, 14–20, 23–25, coloured white in Fig. 2), coincided essentially with those found in the 1970s and have, therefore, been numbered the same as in the 1970s. The other 12 are coloured grey in Fig. 2. The areas occupied by the 1970s Groups 12, 13, 21 and 22 were visited on several occasions but no shrikes were found, and these numbers are not used in Fig. 2. The area east of Ayido Crescent, which was part of the 1970 territory of Group 3, was overgrown with Neem in 2004 and it has been assumed that Group 3 moved across the Legon road and annexed part of the 1970 territory of Group 1.

No estimates of the size of Groups 2, 6, 23, 24, 27 and 32 were possible. The maximum number of shrikes recorded in the other 27 groups on the campus ranged from four to 15 (Table 1). The average maximum number per group for the 17 groups that occupied 1970s areas (white in Fig. 2) was 9.47 ± 2.84 (SD) birds and that for the ten grey groups was 8.30 ± 3.26 birds. These are not statistically different.

Table 1. Maximum numbers of Yellow-billed Shrikes recorded in 27 groups from late January to late April 2004. Group identifier numbers in parentheses (Fig. 2).

Maximum birds	Number of groups	Maximum birds	Number of groups
4	2 (10, 33)	10	4 (4, 16, 19, 29)
5	1 (26)	11	1 (25)
6	2 (9, 34)	12	3 (5, 14, 18)
7	4 (1, 3, 30, 37)	13	2 (20, 31)
8	5 (7, 8, 15, 17, 35)	14	1 (28)
9	1 (36)	15	1 (11)

Of the 33 groups found on the campus, 21 laid one or more clutches prior to and during the three months of my stay (details in Appendix 1). Nests were built by ten other groups but no eggs were laid in these as far as it was known (Appendix 1). Of these ten, those built by Groups 7, 17, 20 and 37 were abandoned through unknown factors, those of Groups 31 and 32 through building construction, those of Groups 10 and 27 through disturbance due to road traffic and those of Group 6 and 33 through student activities. No nests were found for Groups 16 and 23. It is likely that several of these groups bred successfully later in the breeding season, which lasts until September in some years (Grimes 1980). There was evidence that a second female competed unsuccessfully for breeding status in groups 14, 19 and 28 (see Grimes 1980 p. 181 and Appendix 1).

Groups 14, 15, 19 and 25 built nests very close to University buildings and fledglings were raised in all of them despite the disturbance from students. Outdoor tutorials were regularly held within 5 m of the nest of Group 19. The nests of Group 25 were within 10 m of a student residence, and the shrikes foraged and fed fledglings within the inner quadrangles of the crowded hall. Those of Groups 14 and 15 were in close proximity to two major thoroughfares, which were used throughout the day.

Discussion

Both the number of shrike groups and the total population of shrikes on the University campus had increased since the 1970s but the timing and rate of increase are unknown. A census in March 1973, when there were 23 shrike groups on the campus, yielded an average of 12 per group giving an estimated total population of 276 shrikes (Grimes 1980 p. 174). The corresponding data for 2004 are 33 groups and 297 shrikes: an average of 9 per group.

Both pollution of the environment and infrastructure development have occurred at Legon since the 1970s, particularly in the last two years, but to a far lesser extent than in areas of the Accra plains that adjoin the campus. In the 1970s and 1980s, grassland, thicket and scattered trees surrounded the campus but these have now been replaced by housing and the campus is effectively a vegetation oasis in a sea of urban development. Some shrike groups therefore may have moved from the plains into the campus as the surrounding areas have been urbanised. However, shrike groups still occur on the Accra plains around Abokobi (8 km north of Legon) and towards Kwabenya (8 km northwest of Legon), and in the older residential suburbs of Accra and in hotel gardens near the International Airport (5 km to the south). As the territories of Groups 12, 13, 21 and 22 became uninhabitable they may have moved into the main campus or else dispersed and joined other groups but their histories are not known. The data suggest that the population of Yellow-billed Shrikes on the campus have been little affected so far by the building programme and the explosion in student numbers. That the number of clutches (21) found in 2004 compares

favourably with those found in the same period in the 1970s (14 in 1970, 17 in 1971 and 1972, 23 in 1973 and 22 in 1974) would support this conclusion.

Although the difference between the mean maximum number of shrikes in the old territories and the newer territories was not statistically significant, their breeding success may be different. In addition, the increase in the number of groups might reduce the overall breeding success of the population from that in the 1970s. The breeding data gathered in this study were insufficient to address these questions.

Acknowledgments

I thank the Registrar of the University of Ghana for permission to adapt the map of the campus that appears in the booklet *University of Ghana* published in 1993. Dr Frank Walsh read and helpfully commented on an earlier draft and George and Rene Dako kindly supplied the tree names.

Reference

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Appendix 1
Territorial interactions and breeding success of groups of Yellow-billed Shrike at Legon, Ghana, in 2004.

Little Legon
Group 1. Territorial interactions with Gp 3 observed regularly. Dependent fledglings most of Mar, suggests laying Jan.
Group 2. Nest with five eggs in bamboo, 8 Mar; two eggs and two young, 17 Mar. Following heavy rain, nest empty, 21 Mar. Eggs laid late Feb to early Mar.
Group 3. Territorial interactions with Gps 1 and 2. Two fledglings about to leave nest, 27 Jan. Second nest under construction in another Neem tree, 8 Mar. Four eggs 21 Mar; four nestlings *c.* 1 week old, 2 Apr; two fledglings, 18 Apr.
Group 26. Dependent fledglings, 3 Apr. This group possibly linked with Gp 27.
Group 7. Interactions with Gp 8. Nest in bamboo thicket, female regularly called from it throughout Feb.
Group 8. Interactions with Gp 7, Feb–Mar. Dependent fledglings throughout Feb and early Mar.

South side of Legon Hill

Group 5. Dependent fledglings, 12 Feb, being fed while female was involved with a new nest. Fledglings from latter nest, 25 Mar. Female calling from a new nest placed high in Copper Pod tree *Peltophorum pterocarpum*, 27 Mar.

Group 6. Nest in a grove of Neem trees, female called regularly from it throughout Feb–Apr. Locality unusual, as grass was long and trees quite dense.

Group 20. Territorial interactions with Gps 18 and 30. Female called from nest in tree on lower slopes of hill, 25 Mar, but this was not located.

Group 28. Female called from nest in bamboo clump, late Jan, but this was abandoned when some shoots were cut down. A second nest was built in Copper Pod tree *c.* 30 m from the bamboo, and female called throughout Feb and into Mar. Nestlings present mid-Mar; left the nest 12 Apr. Whilst fledglings were being fed, 13 Apr, the breeding female built a third nest in the same Copper pod tree and called from it throughout the rest of my stay.

Whilst the breeding female was incubating, a second female began calling on 5 Mar from a nest in a *Tabebuia mimosa* tree, *c.* 100 m north of the Copper Pod tree. Perhaps competing for breeding status within the group, she called daily from this nest until 22 Mar, then abandoned the site.

Group 29. Interacted with Gp 4. Dependent fledglings, 30 Jan; still being fed, though infrequently, 3 Mar. Female called regularly from nest in Neem tree throughout Feb, Mar and up to 14 April. First egg laid 7 Apr but nest empty 9 Apr.

Group 30. First nest found late Jan but abandoned due to disturbance. A second built in a Candle *Zanthoxyllum xanthoxyloides* tree, 18 Feb; three eggs, 4 Mar; one 7 Mar; none 8 Mar, but nest still used by female throughout Mar; one egg in same nest, 26 Mar; three 28 Mar; four 31 Mar; all hatched by 15 Apr. Period between laying of first egg and hatching of first egg, 17 days.

Volta Basin group

Group 19. Territorial interaction with Gp 25. Nearly independent fledglings, 25 Feb; empty nest in a Frangipani *Plumeria* bush next to University Avenue. Two fledglings, barely able to fly, 5 Mar, but nest not found. New nest built in bamboo clump *c.* 50 m from first nest, 6 Mar, some material taken from the first nest. Three noisy nestlings, 7 Apr; left nest, 15 Apr. From late Jan, a second female called from a nest in a Candle Tree, 26 Jan, *c.* 30 m from the bamboo clump; continued to do this throughout Feb–Mar, though less frequently, and again in Apr. A fledgling seen on 5 Mar was found the next day at the base of this Candle Tree. Adult shrikes fed it while this second female called from her nest and was visited and fed by adult shrikes. Probably represents a female competing for breeding status within the group.

Halls of Residence group

Group 25. Three small fledglings, 8 Feb and throughout Feb–Mar. New nest built early Mar. Two fledglings *c.* 1 week out of nest, 11 Apr.

Lower Hill groups
Group 4. Two fledglings, *c.* 1 week out of nest, 31 Jan; still being fed 29 Feb.
Group 24. Fledglings Mar.

Mensah Sarbah Hall group
Group 33. Nest in large *Ficus* tree, 19 Feb. Female called from nest during the rest of Feb and early Mar but abandoned probably due to disturbance from soccer games regularly played nearby. Female called from new nest in *Anogeissus leiocarpus* tree *c.* 30 m from *Ficus* tree, mid-Mar to early Apr but again abandoned. A third nest, in a more remote *Cassia* tree, was used throughout the rest of my stay.

Primary School compound
Group 9. Interactions with Gp 27. Nest in Copper Pod tree near edge of ring road, 19 Feb. Two fledglings, 25 Feb. Three days later, female began building a new nest in a Copper Pod tree *c.* 15 m from first tree. Regularly called from this nest throughout Mar and into Apr.
Group 27. Interactions with Gp 9. Female used nest in Copper Pod tree from third week of Feb to early Mar before abandoning it through disturbance from traffic and school children. Second nest built mid-Apr.

East Legon
Group 10. Nest in Copper Pod tree, 6 Feb. Female called from it throughout Feb to late Mar, but abandoned due to disturbance from traffic.
Group 11. Interactions with Group 14. Two noisy fledglings throughout Feb were still begging 19 Mar but not in Apr.

Physics/Geology/Geography/Balme Library
Group 14. Territorial disputes with Gp 32. Female called from nest in a Mahogany *Khaya senegalensis* tree, 6 Feb. Fledglings, *c.* 1 week out of nest, 23 Mar. Same fledglings, 30 Mar, within 2 m of the tree in which a second female had built a nest and probably was competing for breeding status. First female called from new nest *c.* 30 m west of the first one, late Mar and into Apr. Construction of nest by competing female started 26 Mar and she called regularly from it during the rest of my stay. She was often fed on the nest.
Group 31. Female called from nest in Copper Pod tree at NE corner of University Library in late Jan. Abandoned through disturbance from construction work. Second nest built in a Copper Pod tree, early Feb, but abandoned by 20 Mar. A third nest started on 21 Apr.

North of Commonwealth Hall, Balme Library and Science departments
Group 15. Dependent juveniles throughout Mar and early Apr.
Group 16. Interacted with Gp 32, Feb–Mar.

Group 18. Interacted with Gp 20. Female called from nest in *Tabebuia pentaphylla* throughout Mar and early Apr; fledglings, 12 Apr.
Group 34. Interactions with Gp 18. Fledglings, *c.* 1 week old, late Jan; with adults throughout Feb.
Group 32. Interacted with Gp 16. Female called from nest throughout early Mar. Construction of a new block of offices was continuous during this period and nest was abandoned.

Botanical Gardens
Group 17. Interactions with Gp 37, late Jan–Feb. Nest in a low branch of Silk Cotton *Ceiba pentandra* tree being built mid-Apr.
Group 37. Possibly same as Gp 32. Interaction with Gp 17, late Jan. Female called from nest in bamboo clump, late Jan and early Feb.
Group 35. Nest built in *Bougainvillea* shrub, early Feb; two eggs 20 Mar; five 24 Mar. Nest failed. New nest in bamboo thicket at the W edge of the gardens, 16 Apr, also abandoned. Third nest started in another *Bougainvillea* clump, 22 Apr.
Group 36. Female called from nest in *Gliricidia sepium* tree, end of Jan. Young fledglings, 10 Apr.