West African Ornithological Society
Société d'Ornithologie de l'Ouest Africain

Join the WAOS and support the future availability of free pdfs on this website.

http://malimbus.free.fr/member.htm

If this link does not work, please copy it to your browser and try again.

If you want to print this pdf, we suggest you begin on the next page (2) to conserve paper.

Devenez membre de la SOOA et soutenez la disponibilité future des pdfs gratuits sur ce site.

http://malimbus.free.fr/adhesion.htm

Si ce lien ne fonctionne pas, veuillez le copier pour votre navigateur et réessayer.

Si vous souhaitez imprimer ce pdf, nous vous suggérons de commencer par la page suivante (2) pour économiser du papier.

February / février 2010

Bull. Nigerian
Orn. Soc. 14(46)

WEIGHT, PRENUPTIAL MOULT AND FEEDING OF BISHOP BIRDS IN NORTHERN GUINEA SAVANNA IN GHANA

by Nicholas C. Davidson

Received 20 March 1978
Revised 20 April 1978

INTRODUCTION

Of the four species of bishop birds that occur in Mole National Park, Ghana, the two smaller ones, Yellow-crowned Bishop Euplectes afer and Red Bishop E. orix, were sufficiently common for me to make a detailed study during a visit in July and August 1975. That is the middle of the wet season, and I have added further information collected during the same season in 1974 and 1976. Both species make an early rains migration (Jones & Ward 1977) and some birds were probably on passage during the study.

Prenuptial moult of bishops in Nigeria has been discussed by Fry (1970) and in Rhodesia by Brooke (1966). Few data have been published about E. afer and information on weight is rather fragmentary (e.g. Britton & Dowsett 1969, Fry 1970, Day 1975, Greig-Smith & Davidson 1977).

METHODS

Birds were mist-netted whilst feeding on weed grasses in disturbed vegetation around park headquarters (09°15'N,01°51'W) and fitted with colour rings. The feeding area was 400 m away from a marsh in which many of these birds subsequently nested. Some birds were also netted in this marsh, and in the surrounding wooded savanna. Weights were measured with a Pesola spring balance accurate to 0.1 gms. The length of wing, tail, tarsus and exposed culmen were measured for each bird.

Body moult was recorded separately for upperparts, underparts and head on a scale of four : (1) predominantly old feathers; (2) approximately half new feathers; (3) predominantly new feathers; and (4) moult complete. For analysis the three body zones were summed, giving a maximum moult score of 12. On capture I was unable to distinguish males in non-breeding plumage from females; although some were subsequently sexed by size, these have not been analysed for fear of bias by separating only the larger non-breeding males.

Information on food and feeding was collected by direct observation of feeding flocks, and some samples were taken by dissection of the gizzard and crop of birds netted in feeding flocks.

WEIGHT AND DIMENSIONS

Weights and dimensions are listed in Table 1. In each species, males and females differ significantly in weight, wing lenth and tail length (Student's t-test, all $P < 0.001$), and tarsal length (both $P < 0.05$). E. afer males average 10.5% larger than females in weight and 3% larger in wing length; likewise E. orix males are 11% and 3.5% larger than females. This is close to the 10% sexual dimorphism in weight found by Fry (1970) for Nigerian E. orix. Neither species is sexually dimorphic in bill length.

Table 1 Euplectes weights and dimensions, Mole National Park, 1974 and 1975. Each value is the mean ± 1 Standard Error

	n	WEIGHT (gms)	WING (mm)	TAIL (mm)	TARSUS (mm)	BEAK (mm)
E. afer ♂	81	14.7±0.30	58.0±0.15	32.1±0.15	16.6±0.14	11.9±0.09
" ♀	44	13.9±0.19	56.1±0.20	30.1±0.31	16.0±0.18	12.0±0.09
E. orix ♂	30	17.0±0.18	62.7±0.27	35.7±0.45	18.2±0.22	12.0±0.28
" ♀	20	15.5±0.49	58.1±0.65	31.9±0.57	17.4±0.31	11.8±0.22

E. orix is significantly heavier and has a longer wing, tail and tarsus than E. afer (all $P < 0.001$), with differences of between 11% (mean weight) and 6.5% (mean wing length). There is no difference in the bill length of the two species. The weights are very similar to those given by Fry (1970) for Mole and Zaria, Nigeria (11°10'N,07°40'E).

WEIGHT CHANGES

Figs. 1 and 2 show the daily weight fluctuations of E. afer and E. orix. Males of each species gained weight during the day, which is substantiated by four E. afer recaptured on different days. E. afer males gain weight in the early morning, fall at noon, and increase again during the afternoon; their afternoon weight increase (4.5%) is greater than the prior decrease (2.6%). Similarly, E. orix males gain weight in the late afternoon by 5.5%. E. afer females gained weight early in the morning, but thereafter did not change; nor did female E. orix show any significant weight changes. Three female E. afer decreased in weight during the day (but as they were same-day recaptures their weight loss reflects lost feeding time and I discount the values), and one female gained weight. Weights of E. orix netted at Mole in July and August 1977 (P. Fisher pers. comm.) show the same pattern of late afternoon weight gain in males and no change in females.

To assess seasonal weight changes it is necessary to exclude any variation due to daily weight change. Consequently, weights have been standardised to the midday level (1200 - 1400 GMT) by the addition or subtraction of the mean percentage differences. E. afer males (Fig. 3) lost weight significantly during July 1975 and the first half of August 1974. Similarly, E. afer females (Fig. 4) lost weight in July 1975 and early August 1974. Four of the five recaptured E. afer males decreased, with adjusted weight losses of up to 14.1% in 11 days. In different individuals weight losses varied between 0.41 gms/day and 0.15 gms/day. A single recaptured E. afer female lost 6.3% in four days or 0.23 gms/day. Neither sex of E. afer lost weight during July 1974, and no significant seasonal weight changes were detected for either male or female E. orix. Ward (1965) shows an early rains weight loss in both sexes of the weaver Quelea quelea.

There was no correlation between weight and prenuptial body moult score in males of either species.

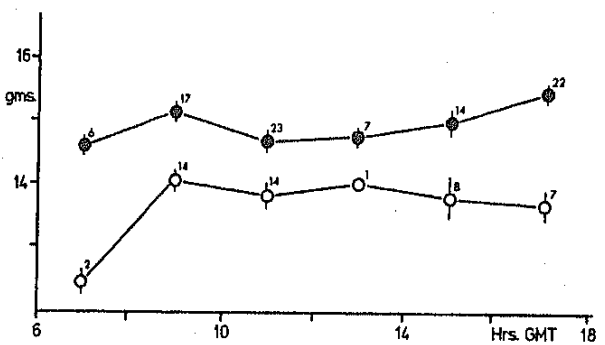

Figure 1 Daily weight variation of E. afer males ● and females o in Mole National Park, Ghana in July and August 1974 and 1975, per two-hour period. Each point is the mean ± 1 Standard Error; numbers are sample sizes. Significant changes (Student's t-test): male: morning gain $t = 2.48$ $P < 0.05$; noon loss $t = 3.92$ $P < 0.001$; afternoon gain $t = 5.31$ $P < 0.001$; female: morning gain $t = 2.41$ $P < 0.05$.

PRENUPTIAL BODY MOULT

Males in prenuptial moult change from streaked brown non-breeding plumage to bright red and black (E. orix) or yellow and black (E. afer) breeding plumage. The beak changes from horn-coloured to black during the moult period. Only body tracts are moulted: no wing or tail moult was noted during the study, and females do not undergo a prenuptial moult.

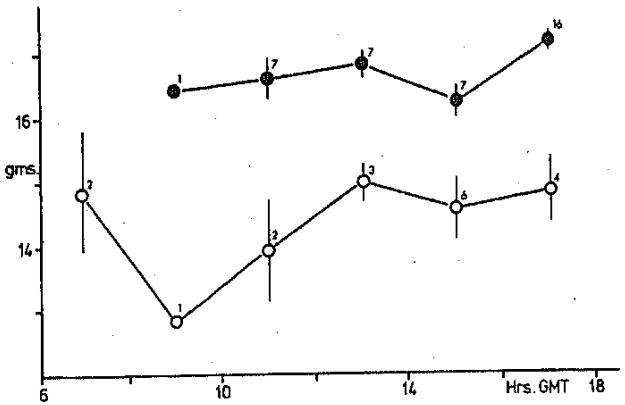

Figure 2 Daily weight variation of E. orix males ● and females ○ . Legend as in Fig. 1. Significant change (Student's t-test): male: afternoon gain $t = 2.43$ $P < 0.05$.

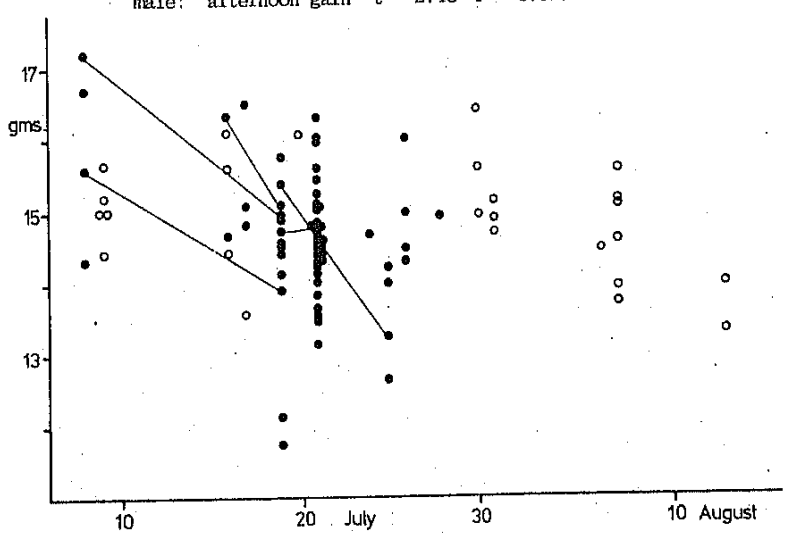

Figure 3 Seasonal weight changes of E. afer males in 1974 ● and 1975 ○ . Weights are adjusted for daily weight variation (see text). Solid lines are recaptures. Correlation coefficients: August 1974 $b = -0.184$ $P < 0.05$; July 1975 $b = -0.079$ $P < 0.05$.

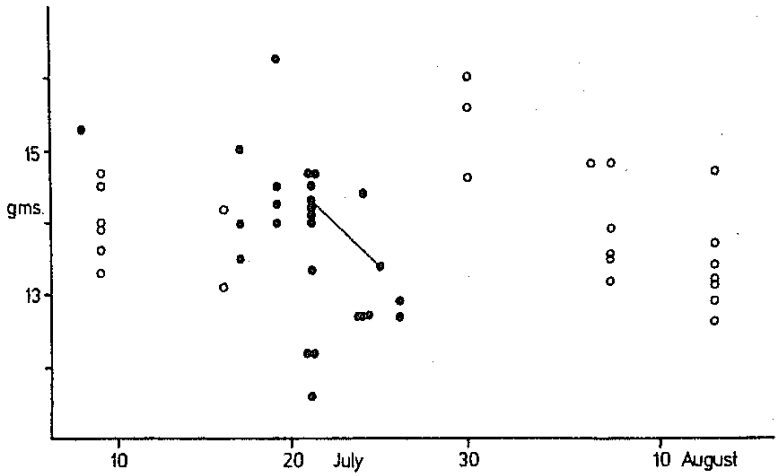

Figure 4 Seasonal weight changes of E. afer females. Legend as in Fig. 3. Correlation coefficients: August 1974 $b = -0.141$ $P < 0.001$; July 1975 $b = -0.156$ $P < 0.01$.

Moult scores are plotted in Fig. 5 (E. afer) and Fig. 6 (E. orix) and the results from 1975 are summarised in Table 2. Moult in the population was estimated from the population means, assuming linearity. In 1975, E. afer moult started in mid-June and finished at the end of July, whilst E. orix moult lasted from the end of June to the third week of August. Linear extrapolation from the date of first completed moult indicates that the earliest individuals of both species began moult at the end of May/beginning of June. In both species, moult begins with the underparts, followed a week later by the upperparts and head. Moult is first completed on the head, with the upperparts and underparts finishing about two days later.

In 1976 (A. H. Cuthbert pers. comm.), E. afer moult timing was similar to 1975, but E. orix moult was a fortnight earlier than in 1975. Of two E. orix ringed in 1975 and recaptured in 1976, one was also two weeks more advanced, but the other had similar timing. A single E. afer recaptured in 1976 also indicates similar timing in both years. Limited data from 1974 indicate that E. afer moult was a fortnight earlier than in 1975, but that E. orix had similar timing.

Table 2 Summary of Euplectes male prenuptial moult, Mole National Park, 1975

	Estimated duration (population)	Estimated duration (recaptures)	First completed moult	Last moult started	Individual variation of timing
E. afer	45 days	36, 44 & 44 days	16 July	21 July	7 weeks
E. orix	52 days	37 days	19 July	28 July	8 weeks

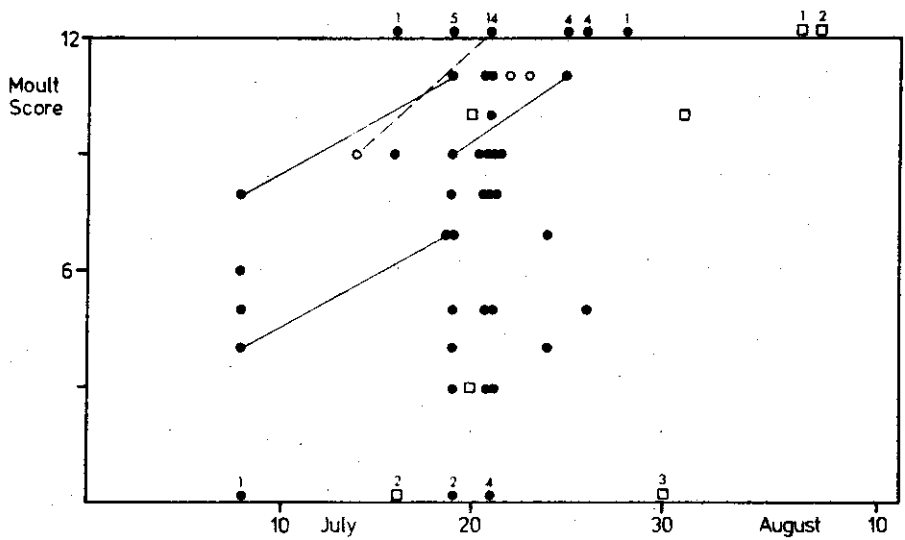

Figure 5 Prenuptial body moult of male E. afer in 1974 □ , 1975 ● and 1976 ○ . Solid lines are 1975 recaptures, and dashed lines are birds ringed in 1975 and recaptured in 1976. Numbers against scores of 0 and 12 are sample sizes - these have been omitted from the analysis.

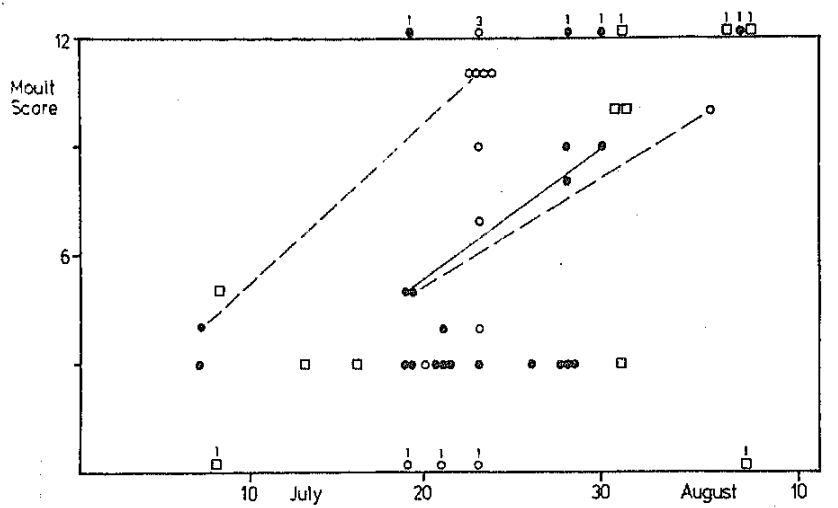

Figure 6 Prenuptial body moult of male E. orix. Legend as in Fig. 5.

FOOD AND FEEDING

Both bishop birds joined large mixed species feeding flocks of 'finches' composed mainly of firefinches Lagonosticta senegala, L. rufopicta, waxbills Estrilda caerulescens, E. melpoda, cordon-bleus E. bengala, canaries Serinus mozambicus and a few of the large bishops Euplectes macrourus and canaries S. gularis. These flocks were feeding on the seeds of abundant weeds and grasses in areas of disturbed vegetation around human habitation. Sometimes E. afer and E. orix formed single-species flocks (⅓ of 57 observations). When a mixed flock was disturbed, each bishop species dispersed on its own, whilst estrildine finches dispersed as mixed groups. Woodall (1971) noted a definite leader (a male in breeding plumage) in a feeding flock of E. orix.

Table 3 lists the plant species from which bishops were seen to take seeds. Sporobolus pyramidalis and Hyperthelia dissoluta are tall grasses (2 - 2.5 m high when fruiting) and generally form monospecific stands, while the other species seldom grow taller than 1 m and grow in mixed stands. Eight gizzard samples were taken on 21 July 1975 (two males and two females each of E. afer and E. orix, all with enlarged gonads), and all contained Brachiaria lata seeds. All E. afer and one male and two female E. orix gizzards contained Digitaria ciliaris, and one male and one female E. afer contained Tridax procumbens. No gizzards contained insect remains.

Table 3 Food plants of bishops in Mole National Park, July and August 1975

Gramineae (grasses)	
Brachiaria brachylopha	Dactyloctenium aegyptium
B. jubata	Digitaria ciliaris
B. lata	Hyperthelia dissoluta
Cymbopogon sp.	Sporobolus pyramidalis
Cyperaceae (sedges)	
Cyperus dilatatus	Mariscus alternifolius
Herbs	
Boerhavia diffusa	Tridax procumbens
B. erecta	

Both sexes of E. afer and of E. orix fed on all the species listed.

Four feeding methods were noted for both bishops. When feeding on small plants, birds perched on the stem until the inflorescence bent to the horizontal and could be reached while the bird was perched upright, a method described by Woodall (1971). When the stem bent double under the weight of the bird, seeds were taken while the bird was hanging head downwards. Birds also perched on an adjacent stem to reach an inflorescence. Seeds of the larger grasses were taken by climbing vertically up the stem to the inflorescence. These methods are typical of those described by Skead (1975) for estrildine finches.

Feeding activity can be gauged by the number of birds netted throughout the day (Evans 1966). To reduce bias I standardised the number of drives per 2-hour period and the net length. The results are shown in Table 4. Both E. afer and E. orix showed highly significant diurnal variation in the time of capture, and they fed mainly in the morning and late afternoon. I found no sexual difference in feeding times nor any interspecific difference in feeding periods.

DISCUSSION

The 1975 moult duration was about the same as Fry (1970) found for E. orix in northern Nigeria (6 - 7 weeks), where however moult started earlier, in the first week of May. The asynchrony I detected conforms with

Table 4 Numbers of E. afer and E. orix netted per two-hour periods from feeding flocks

Hrs. GMT	0801-1000	1001-1200	1201-1400	1401-1600	1601-1800
E. afer ♂	22	7	3	4	22
" ♀	9	5	1	2	7
" total	31	12	4	6	29
E. orix ♂	6	0	1	2	14
" ♀	1	2	2	2	2
" total	7	2	3	4	16

Netting effort from 0600-0800 GMT was light and has been omitted. Significant differences between time-periods: E. afer $X^2 = 42.71$ $P < 0.001$; E. orix $X^2 = 25.66$ $P < 0.001$.

other findings: two months in E. orix (Skead 1956) and at least five weeks in E. nigroventris (Moreau & Moreau 1938). Brooke (1966) and Woodall (1971) suggested that the timing of moult and breeding in E. orix is influenced by rainfall and its consequent effect on vegetation growth. Similarly, Whybrow (1950) recorded delayed breeding by E. hordeacea in drought conditions. At Mole, although some rain falls in April, heavy rains do not start until June (Maze 1970). The moult data suggest that most E. afer start moulting in mid June and most E. orix in late June. Jones & Ward (1977) have shown that at Maiduguri, northern Nigeria, these small bishops migrate south at the start of the rains; at Mole they became more abundant at the beginning of July 1975, suggesting arrival with an early-rains migration (but see Elgood, Fry & Dowsett 1973). Unfortunately, information on seasonal changes in bishop numbers at Mole has not been collected (see Greig-Smith 1977). Whilst the start of the rains and the consequent food shortage (see Ward 1965) influence migration and probably moult (Jones & Ward 1976) and lead to an onset of gametogenesis (Immelmann 1970) in related species and presumably bishops, it seems unlikely that subsequent rainfall and vegetation growth in the breeding area will have influenced the timing of moult and breeding, since the birds are absent on migration for much of this period. Jones & Ward (1976) suggest that not only does individual body condition influence breeding time in the weaver Quelea quelea, but also that preparatory changes such as prenuptial moult are under endogenous control. That would account for the great asynchrony of moult in the present study. The differences in the timing of moult in different years may be related to the timing of the onset of the rains: for example, the rains in 1974 were later than in 1975, so were E. afer moult and weight loss.

The causes of the pattern of weight changes are not clear. The seasonal weight losses in E. afer may be due to the loss of migratory fat reserves (Jones & Ward 1977) after return to the breeding grounds. Alternatively it may be due to a change in foraging behaviour resulting in less food storage in the crop once breeding commences. However, the regular presence of colour-marked birds on feeding areas close to the breeding ground makes this unlikely. Further, there was no weight difference between birds netted in the breeding marsh and those from feeding areas. The high weights of E. afer during July 1974 may indicate that at least some birds were on passage to breed further north (e.g. Pearson 1971). Similarly, the steady weight of E. orix in both years may also be due to passage birds, and appears correlated with the later moult and breeding (pers. obs.) compared with E. afer.

The morning and late afternoon weight gains by males of both species are similar to those of Q. quelea (Ward 1965), attributed to the replacement of food used during the night-time and midday periods of inactivity. The gains by bishops occurred during the periods of peak foraging activity and are probably the result of daily fattening (e.g. Ward 1969) and food storage in the crop (e.g. Newton 1969). Why females do not gain weight in the late afternoon is unclear - perhaps because they need more protein reserves than males for breeding (see Jones & Ward 1976).

The size differences between the two species are of the same magnitude as intraspecific sexual differences, and there is considerable overlap in dimensions. That the two species have the same sized beaks emphasises their similarity in food and feeding habits.

ACKNOWLEDGEMENTS

I am grateful to Dr E. O. Asibey and the Ghana Game and Wildlife Department for permission to work in Mole National Park, and for much assistance. The work was financed by grants to the 1st and 2nd Aberdeen University Expeditions to Ghana. Mr A. H. Cuthbert allowed me access to data collected during the 3rd Aberdeen University Expedition to Ghana in 1976, and Mr P. W. Greig-Smith supplied additional information from 1975. Mr J. B. Hall of the University of Legon, Ghana kindly identified the plant species. Dr P. R. Evans and Messrs P. W. Greig-Smith and M. W. Pienkowski made valuable criticisms of an earlier draft of this paper.

SUMMARY

Wet season weight, prenuptial moult and feeding of the bishops Euplectes afer and E. orix were studied in Mole National Park in 1974 and 1975. Weights and dimensions are tabulated. Males were heaviest in mid-morning and late afternoon, corresponding with feeding peaks. Females gained weight before noon but not after. No feeding segregation was found. E. afer lost weight during the mid wet season. Male prenuptial moult took 45 days in E. afer and 52 days in E. orix, with the first individuals

starting at the end of May, and with asynchrony of at least four weeks from the mean. The timing of the seasonal weight loss and prenuptial moult synchronised with the start of the rains, two weeks earlier in 1974 than 1975.

RÉSUMÉ

Le poids en saison humide, la mue prénuptiale et le comportement alimentaire des Euplectes Euplectes afer et E. oryx ont été étudiés en 1974-75 au Parc National du Mole. Les poids et dimensions sont exposés dans les graphiques. Les mâles sont plus lourds au milieu de la matinée, et en fin d'après midi, en accordance avec les périodes de prise de nourriture. Les femelles gagnent du poids avant midi, mais non après. Aucune ségrégation n'a été notée pendant la prise de nourriture. E. afer perd du poids durant la saison humide. La mue prénuptiale dure 45 jours chez E. afer, 52 jours chez oryx, les premiers individus commençant fin mai, avec une asynchronie d'au moins 4 semaines par rapport à la moyenne. Il y eut coïncidence de la perte de poids saisonnière et de la mue avec l'arrivée des pluies: deux semaines plus tôt en 1974 qu'en 1975.

REFERENCES

Britton, P. L. & Dowsett, R. J. (1969) More bird weights from Zambia. Ostrich 40: 55-60

Brooke, R. K. (1966) Nuptial moult, breeding season and clutch size of Rhodesian Red Bishops Euplectes orix and congeners in relation to rainfall. Ostrich Suppl. 6: 223-235

Day, D. H. (1975) Some bird weights for the Transvaal and Botswana. Ostrich 46: 192-194

Evans, P. R. (1966) Autumn movements, moult and measurements of the Lesser Redpoll Carduelis flammea cabaret. Ibis 108: 183-216

Fry, C. H. (1970) Migration, moult and weight of birds in Northern Guinea savanna in Nigeria and Ghana. Ostrich Suppl. 8: 239-263

Greig-Smith, P. W. (1977) Bird migration at Mole National Park, Ghana. Bull. Nigerian Orn. Soc. 13: 3-14

Greig-Smith, P. W. & Davidson, N. C. (1977) Weights of West African savanna birds. Bull. Brit. Orn. Club 97: 96-99

Immelmann, K. (1970) Environmental factors controlling reproduction in African and Australian birds - a comparison. Ostrich Suppl. 8: 193-210

Jones, P. J. & Ward, P. (1976) The level of protein reserve as the proximate factor controlling the timing of breeding and clutch size in the Red-billed Quelea Quelea quelea. Ibis 118: 547-574

Jones, P. J. & Ward, P. (1977) Evidence of premigratory fattening in three tropical granivorous birds. Ibis 119: 200-203

Maze, R. L. (1970) A prelimínary study of the Guinea savanna avifauna at Mole Game Reserve in Ghana. Ghana J. Science 10: 38-48

Moreau, R. & Moreau, W. (1938) The comparative breeding ecology of two species of Euplectes (Bishop-birds). J. Anim. Ecol. 7: 314-327

Newton, I. (1969) Winter fattening in the Bullfinch. Physiol. Zool. 42: 96-107

Pearson, D. J. (1971) Weights of some Palearctic migrants in Southern Uganda. Ibis 113: 173-184

Skead, C. J. (1956) A study of the Red Bishop Bird. Ostrich 27: 112-126

Skead, D. M. (1975) Ecological studies of four estrildines in the Central Transvaal. Ostrich Suppl. 11: 1-55

Ward, P. (1965) The feeding ecology of the Black-faced Dioch Quelea quelea in Nigeria. Ibis 107: 173-214

Ward, P. (1969) Seasonal and diurnal changes in the fat content of an equatorial bird. Physiol. Zool. 42: 85-95

Whybrow, C. (1950) Effects of drought on the nesting of the Fire-crowned Bishop Euplectes hordeacea. Ibis 92: 317

Woodall, P. F. (1971) Notes on a Rhodesian colony of the Red Bishop. Ostrich 42: 205-210

N. C. Davidson, Department of Zoology, University of Durham, Science Laboratories, South Road, Durham DH1 3LE