

7

Identifying quelea populations by trace element analysis of feathers

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Introduction

Damage by the Red-billed Quelea *Quelea quelea* to ripening cereal crops is often more intense in some areas than in others. Localized damage is predictable because it is caused by concentrations of quelea that annually arrive in an area as crops ripen. Simultaneously, other nomadic groups of quelea in non-crop areas feed on maturing native grasses. This is their natural behaviour, and quelea probably prefer native grass seeds to cereal crops (Ward 1973a). Because some groups cause crop damage while others do not, protecting crops can best be accomplished by reducing those groups of quelea that predictably feed on crops. Therefore, the annual movements and nesting locations of groups that cause damage must be identified.

Identifying quelea populations

Various attempts have been made to identify quelea populations by plumage and morphological features (Ward 1966, 1973b; Chapter 4) and to study their long-distance movements by ringing birds (Disney 1960) or marking them with fluorescent particles (Jaeger *et al.* 1986; Chapter 5). Here we examine another technique, the amounts of trace elements in feathers, that may be helpful in identifying various quelea populations.

For more than three decades, wildlife biologists have used trace elements in birds' feathers to identify discrete populations. The earliest work was with Ruffed Grouse *Bonasa umbellus*, where regional differences were found in the mineral composition of feathers (Grant 1953; McCullough 1953). Considerable research followed on waterfowl to define natal areas (Devine and Peterle 1968; Hanson and Jones 1968; Kelsall and Burton 1977; Kelsall and

Calaprice 1972; Neth 1971). Hanson and Jones (1976) examined soils and plants as well as goose feathers to relate minerals in habitats with those in feathers. Later work showed that feathers from Kirtland's Warblers *Dendroica kirtlandii* had large differences in mineral composition among individuals (Means 1981), which made identification of groups in the population difficult. However, Parrish *et al.* (1983) readily distinguished subpopulations of Peregrine Falcons *Falco peregrinus* by their feather minerals.

The levels of different elements in feathers are believed to be influenced by the relative availability of those elements in habitats where feathers are produced. The mineral level in the diet largely determines the kind and amount of elements in feathers, although this can be modified by differences in the absorption and excretion of elements by the animal. The levels ultimately deposited in growing feathers create a mineral profile that can be similar for all birds of a species that grow feathers in a particular area.

Mineral profiles are most uniform among individuals of species, such as waterfowl, that moult all of their flight feathers at one time. The new flight feathers produced in the area where birds are flightless tend to contain the same kinds and amounts of trace elements. Likewise, young birds raised in an area should have the same profiles in their juvenile feathers because they all eat similar foods and ingest comparable minerals while growing their feathers. In species that move while sequentially moulting feathers, mineral profiles become more variable among individuals, but birds moving together and moulting in unison should have similar levels of minerals in their feathers.

Most workers have found that some differences in mineral profiles are related to sex and age of birds, age of feathers, feathers examined, and methods chosen for washing and analysing feathers. Variations among sex, age, and individuals can result from differences in food habits, physiology, and metabolism (Kelsall *et al.* 1975). Kelsall and Burton (1979) found that trace element profiles of individuals from different groups of Snow Geese *Chen caerulescens* could show similarities, but large sample sizes ($n \approx 40$) were necessary to separate groups. They felt the usefulness of the technique depended on how finely it was necessary to subdivide a population, but concluded that with adequate sample sizes some separation of groups within a population was possible.

A considerable and common problem in using feather mineral profiles to identify groups within a bird population is that feather composition can change over time. Kelsall and Burton (1979) noticed significant changes in feather profiles of captive geese between October and May. Other work with Canada Geese *Branta canadensis* suggested that some ions in the environment were adsorbed on to feathers with time (Edwards and Smith 1984). When geese were moved to different environments, ion exchange created new mineral profiles in feathers. Nevertheless, group affinities and profiles were

maintained and, with adequate sample sizes, birds that moulted together could later be identified.

Collecting and analysing quelea feathers

In 1981, primary feathers were collected from *Q. q. quelea* in Senegal, *Q. q. intermedia* in Tanzania, and *Q. q. aethiopica* in Ethiopia to compare mineral profiles among these three subspecies of quelea. In addition, primary feathers were obtained from different groups of quelea within Ethiopia and adjacent western Somalia to examine differences among more local bird concentrations. Details of feather collections are given in Table 7.1. In Somalia, birds had suspended their moult. This offered the opportunity to compare 1-year-old feathers with newly developed ones from the same birds. Samples of old and new feathers were selected on the basis of their availability. In 27 cases, samples of old and new feathers were obtained from the same bird.

Feathers from each bird were analysed as individual samples. The first six primaries taken from the right wings of birds weighed at least 30 mg and provided enough feather material for analyses. To remove oils and adhered particles, feather samples were sonicated twice in water, once in acetone, and then rinsed twice in acetone. Samples were ashed in a muffle furnace and submitted for analysis by emission spectroscopy. Analyses were conducted by Spec Resources, Denver, Colorado. This technique provided only semi-quantitative data, but it permitted multi-element analysis at a reasonable cost. In this study, we wished to determine the levels of trace elements in quelea feathers and the ones that varied sufficiently to be of help in discriminating between populations. More quantitative methods can be used in future work once the diagnostic elements are identified. The emission spectrographic analyses were automated so that 24 samples were analysed as a group. As the method is semi-quantitative, variations were expected between each run of 24 samples. To reduce the bias of differences between runs, some samples from each collection were analysed in each run.

Analyses were conducted in three lots. The Ethiopia Colony B collection was analysed first to determine the results that could be expected. Samples were analysed in two runs of 21 and 22 samples. Techniques used in preparing and analysing Colony B samples were exploratory and somewhat different than those for other samples; therefore, the results are presented separately. The second lot consisting of collections from Senegal, Tanzania, and Ethiopia (Colony D) was analysed to see if feather mineral profiles differed among quelea subspecies. Each of these collections of 40 samples was divided into five groups of eight samples each. One group of samples from each country was combined into a run of 24 samples. It took five runs to analyse all 120 samples from the three countries. An identical approach

Table 7.1. Description of feathers collected from quelea in Africa during 1981. Collections consisted of primary feathers from 40 individuals in all areas except Colony B ($n=43$).

Location	Concentra-tion	Date (1981)	Age	Sex	Wing	Primary nos. analysed	Collector
Tanzania Arusha	Colony	15 June	Juveniles	M and F	Right and left	1-3	C. C. H. Elliott
Ethiopia Lake Chew Bahir	Colony B	22 May	Adults	M	Right	1-6	M. M. Jaeger and R. L. Bruggers
Lake Chew Bahir	Colony D	8 June	Adults	M	Right	1-6	M. M. Jaeger and R. L. Bruggers
Melkassa	Colony	30 Sept.	Adults	M	Right	1-6	M. M. Jaeger and R. L. Bruggers
Somalia Hargeisa ^a	Roost	15 Sept.	Adults	M and F	Right and left	As available ^b	H. Musa
Senegal Richard Toll	Colony	23 Sept.	Adults	M	Right	1-6	Ph. Ruclle

^aBirds killed by chemical sprays.

^bOld feathers—21 males, right wings; 19 males, both wings. New feathers—35 males, both wings; 5 females, both wings.

was used to analyse the final lot, which consisted of feathers from Melkassa in Ethiopia and the old and new feathers from Hargeisa in Somalia.

Levels of trace elements are reported in parts per million (p.p.m.) based on the dry-weight of feathers. Graphic presentations of results are similar to those used by Hanson and Jones (1976) and depict a mineral profile for feathers from each population of quelea. Data obtained on trace element levels in feathers were not normally distributed; many results were reported as zeros or traces. A zero meant either that elements were not present or were present at undetectable levels. In other samples elements were present but levels were too low to be quantified (trace levels). In the latter case, values equal to the lowest levels that could be quantified were assigned to elements. These values differed for each lot of samples (Table 7.2).

Kruskal-Wallis tests were used to analyse data on trace elements in feathers from Senegal, Tanzania, Ethiopia, and Somalia (old feathers). Non-parametric multiple comparisons were made to separate means. Assessment of differences in mineral levels between old and new feathers from Somalia was made with Wilcoxon's signed rank test. Finally, non-parametric, nearest neighbour, discriminant analyses were conducted to evaluate how well mineral levels permitted identification of quelea groups and which minerals were the most useful. All minerals except magnesium increased discrimination. Values were obtained on the percentage of samples from each popula-

Table 7.2. Lowest levels (p.p.m.) of quantitation for different lots of samples and amounts of trace elements found in feathers from Colony B, Ethiopia.

Trace elements	Lowest levels (p.p.m.)			
	Ethiopia (Colony B)	Senegal, Tanzania, and Ethiopia (Colony D)	Melkassa and Hargeisa, old and new	Levels from Colony B, Ethiopia ($\bar{x} \pm SE$)
Iron	90	100	70	180 \pm 22
Magnesium	30	40	40	76 \pm 5.8
Calcium	100	90	80	179 \pm 9.4
Titanium	4	4	2	66 \pm 7.5
Manganese	2	2	1	26 \pm 1.9
Boron	2	2	2	38 \pm 1.5
Zinc	20	40	30	71 \pm 4.6
Silicon	2000	1800	1400	2000 \pm 0.0
Sodium	90	130	100	206 \pm 9.6

tion that could be correctly classified by using the eight elements other than magnesium.

Quelea trace element profiles

Feathers from Colony B in Ethiopia were analysed first to determine which trace elements were present, and which elements varied sufficiently to help possibly in differentiating between groups of quelea. Analyses were made for thirty-five elements in Colony B feathers. Thirteen of these elements, if present, occurred at levels below the detection limit for emission spectroscopy. Analyses for two elements, aluminium and potassium, gave highly variable results; emission spectroscopy apparently was a poor method for measuring these elements in feathers. Eleven elements either were present in trace amounts or varied only slightly among samples, both of which limited their diagnostic value. For the remaining nine elements (iron, magnesium, calcium, titanium, manganese, boron, zinc, silicon, and sodium), levels varied over a large enough range to permit some recognizable differences among samples. Average levels for these latter elements in Colony B feathers are listed in Table 7.2, and a mineral profile is shown in Fig. 7.1.

Levels of these nine elements were then determined for the feather samples from Senegal, Tanzania, and Ethiopia (Colony D). This was done to compare feather elements in birds from populations known to be discrete because of geographic separation. Mineral profiles for these three populations were different (Figs. 7.1 and 7.2). Amounts of titanium and boron were different ($P \leq 0.05$) in each of the populations, while at least one population could be separated from the other two by using levels of iron, manganese, zinc, silicon, and sodium (Table 7.3). All three populations had similar amounts of magnesium and calcium in feathers.

Discriminant analyses indicated that 75.0, 97.5, and 80.0 per cent of individual quelea from Senegal, Tanzania, and Ethiopia (Colony D), respectively, could be correctly assigned to their place of origin by using levels of trace elements found in their feathers. All minerals except magnesium increased discrimination. Thus, separation of the subspecies of quelea in Africa was possible by using trace element analyses. Because birds lived in distinctive habitats and were isolated from each other, this was expected.

Analyses subsequently were conducted to determine if trace elements were distinctive for groups of quelea within Ethiopia. Collections of feathers from Melkassa in eastern Ethiopia and from Hargeisa (old feathers) in north-western Somalia were compared with each other and with those from Colony D in south-western Ethiopia (Figs. 7.1, 7.2, and 7.3). Levels of iron in feathers were different in all three areas ($P \leq 0.05$). For each of the other eight trace elements, levels from one area always differed ($P \leq 0.05$) from those in

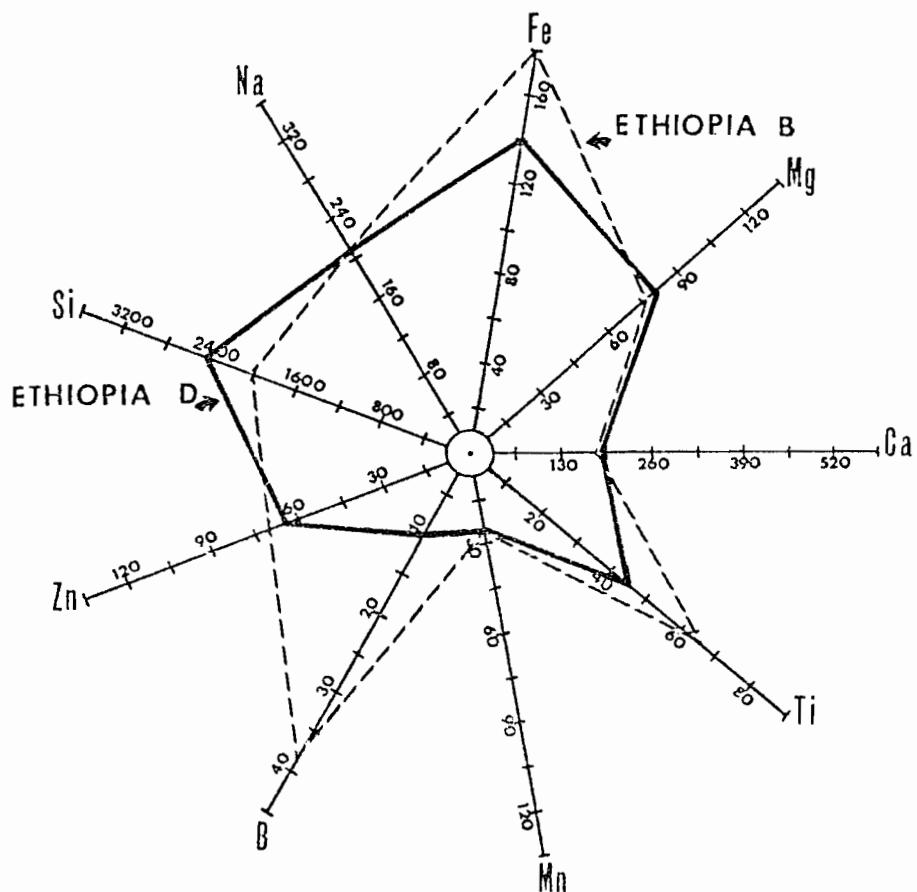


Fig. 7.1. Polygons depicting mean levels (p.p.m.) of nine trace elements in quelea feathers from Ethiopia (Colony B and D). Profiles of the colonies appear similar except for differences in boron.

one or both of the other areas (Table 7.3). Discriminant analyses of these data allowed correct assignment of individual birds to their groups in 85 per cent of cases for Hargeisa and 80 per cent for Melkassa and Colony D. Thus, groups of birds from the Awash Valley and adjacent areas seem to be separate and distinct from one another and can be identified by trace elements in their feathers.

The trace element composition of old and new feathers from the wings of the 40 birds collected in Hargeisa, Somalia, were quite different. Mineral profiles differed more due to age of the feathers (Fig. 7.3) than did other collections among populations. For all elements, except zinc and sodium, mineral levels appeared higher in old feathers than in new ones (Table 7.3). In 27 cases, samples of old and new feathers were obtained from the same bird and statistical comparisons of those samples suggested real differences existed among all minerals except zinc ($P \leq 0.05$).

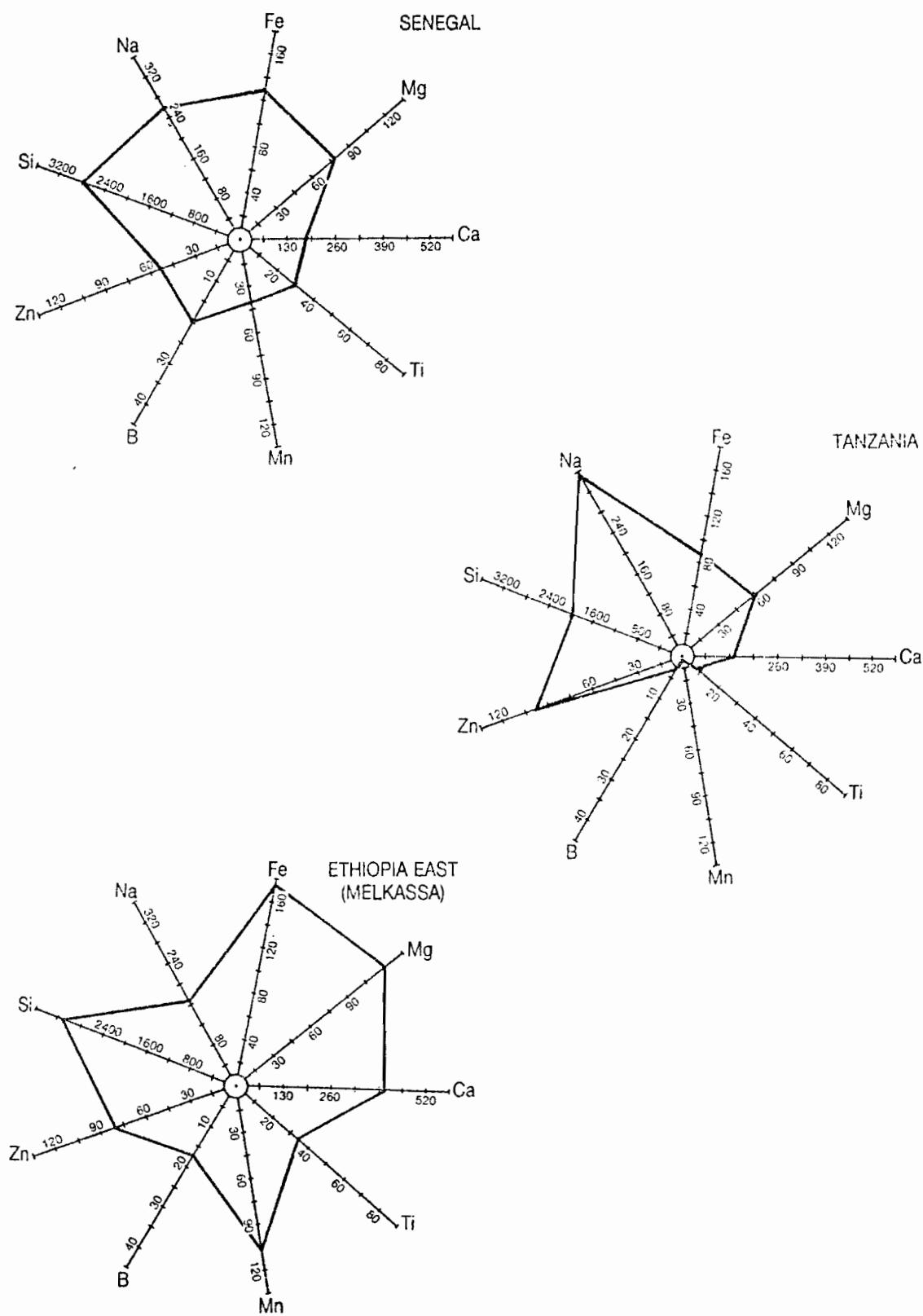


Fig. 7.2. Polygons depicting mean levels (p.p.m.) of nine trace elements in quelea feathers from Senegal, Tanzania, and Ethiopia (Melkassa). The profiles appear different from each area.

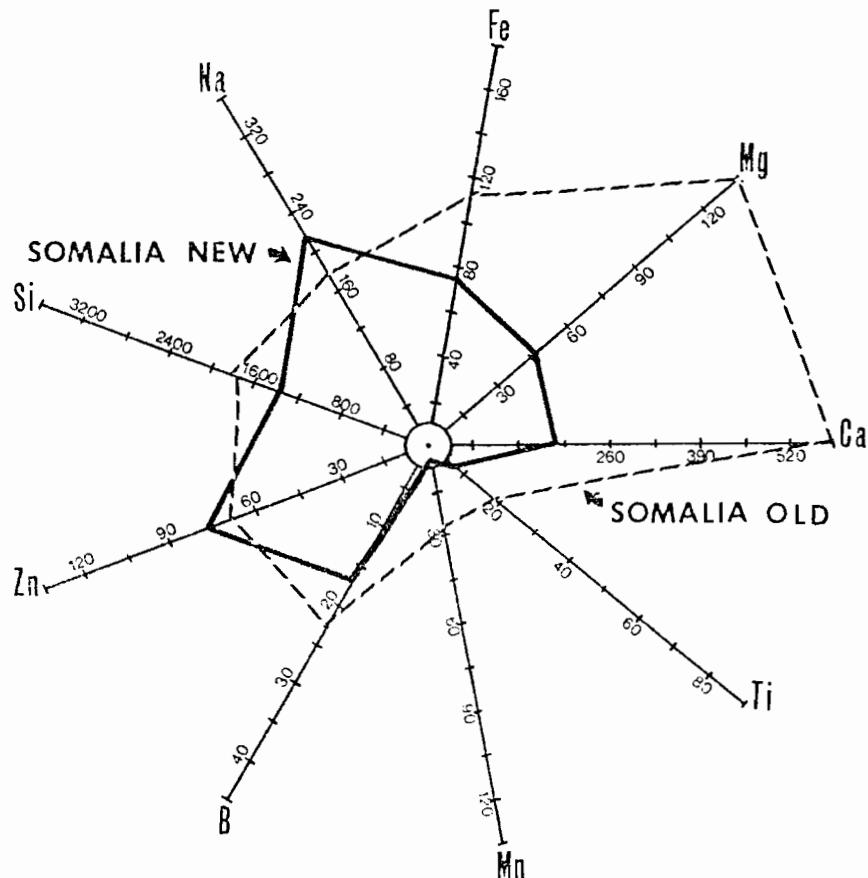


Fig. 7.3. Polygons depicting mean levels (p.p.m.) of nine trace elements in old and new quelea feathers from Somalia (Hargeisa). The profiles are distinctly different.

Discussion

In 1981, Jaeger *et al.* (1986) undertook intensive searches for quelea breeding colonies in the vast flood plain above Lake Chew Bahir, Ethiopia. This area, inhabited by nomadic herdsmen, contains little agriculture, but the grasslands offer ideal breeding habitat for quelea. At three colonies (B, D, and E) in south-western Ethiopia quelea were sprayed with fluorescent particles of different colours to mark them for later identification. Three quelea marked in Colony E were found 100 days later and 600 km away in the breeding colony near Melkassa, where birds were collected for trace element analysis.

Colonies B and D in Ethiopia were adjacent to each other and birds from the two colonies had similar mineral profiles in feathers (Fig. 7.1). Only levels of titanium and boron differed ($P \leq 0.05$), and differences were large only for boron. In contrast, feathers of birds from the Melkassa colony, where the marked birds from Colony E were found, had trace element levels that differed ($P \leq 0.05$) from those found in Colony D for all elements except titanium and silicon (Table 7.3).

These findings suggest several possibilities. If the Melkassa colony was

Table 7.3. Levels of trace elements (p.p.m.; $\bar{x} \pm \text{SE}$) in feathers of quelea from five areas of Africa. For each element, means that do not share the same letter in parentheses are different ($P \leq 0.05$).

Trace elements	Location					Somalia (Hargeisa)*		
	Senegal (Richard Toll)	Tanzania (Arusha)	Ethiopia		Old feathers	New feathers		
			Colony D	Melkassa				
Iron	129 ± 8.6 (b)	88 ± 5.3 (c)	139 ± 9.9 (b)	175 ± 13 (a)	111 ± 12 (c)	73 ± 1.6		
Magnesium	78 ± 5.4 (b)	58 ± 2.3 (b)	80 ± 5.7 (b)	122 ± 9.7 (a)	135 ± 13 (a)	47 ± 2.9		
Calcium	181 ± 8.5 (b)	143 ± 5.5 (b)	186 ± 10 (b)	411 ± 28 (a)	583 ± 42 (a)	182 ± 14		
Titanium	30 ± 2.0 (b)	7 ± 1.1 (d)	45 ± 2.6 (a)	34 ± 2.0 (a,b)	19 ± 1.7 (c)	7 ± 1.6		
Manganese	41 ± 5.5 (b)	2 ± 0.02 (c)	25 ± 1.5 (b)	107 ± 8.0 (a)	28 ± 2.6 (b)	5 ± 0.70		
Boron	20 ± 1.5 (a)	3 ± 0.30 (c)	10 ± 1.0 (b)	17 ± 1.5 (a)	23 ± 2.9 (a)	17 ± 2.4		
Zinc	53 ± 1.7 (d)	97 ± 4.7 (a)	65 ± 3.2 (c,d)	81 ± 3.0 (a,b)	69 ± 2.9 (b,c)	76 ± 3.7		
Silicon	2780 ± 202 (a)	2000 ± 0.0 (b)	2439 ± 119 (a)	3100 ± 206 (a)	1747 ± 110 (a)	1400 ± 0.0 (c)		
Sodium	261 ± 8.7 (a)	365 ± 14 (a)	210 ± 7.5 (b)	165 ± 6.7 (c)	178 ± 8.0 (b,c)	217 ± 10		

*Means for old and new feathers were analysed separately; means where different ($P \leq 0.05$) for all elements except zinc.

composed largely of Colony E birds, then Colony E birds appear quite distinct from quelea in Colonies B and D, which were only 56 km away. Thus, the many colonies found in 1981 throughout south-western Ethiopia and northern Kenya may have been composed of quelea from several different subpopulations. Their common use of this area for breeding may be a response to the excellent nesting habitat there, rather than an indication of any particular affinity with each other. Jaeger *et al.* (1986) found that quelea colour-marked in Colonies B, D, and E were segregated from each other when recovered 1-3 months later between 500 and 700 km to the north-east. Differences in trace element profiles among quelea in the Awash Valley support their findings that discrete groups of birds move and breed throughout the area whereas, at one time, all birds were thought to be part of a single homogeneous population.

Levels of specific trace elements sometimes varied considerably among the feather samples within a collection. The range of values for some elements was large, but often values were clustered around several different levels. This suggested that even individual collections may have contained birds from different sources. Several approaches were used to see if birds in collections were composed of different groups that could be recognized by trace element levels in feathers. First, trace element profiles were compared to mask classifications of males (see description of masks in Chapter 4). At the time they were collected, the 43 birds from Colony B were classified by mask type. Most birds (23) were classified as type 1, while others had mask types 2 (10), 3 (1), 4 (2), 5 (3), and 6 (4). No consistent similarities were found to suggest that those with the same mask type had similar mineral profiles. Next, groups of samples from Colony D were examined that had unusually high or low levels of specific elements. These groupings also did not show any consistent patterns for levels of other elements, and no distinctive mineral profiles for these groups were obvious.

Apparently, variations in feather elements within collections were not related to any unique history of the birds. They were either normal variations in mineral content or an artefact resulting from the semi-quantitative method used for chemical analyses. We have established which elements are of greatest diagnostic value, and now a more quantitative analytical method can be used to reduce variation within collections and provide more precision in distinguishing birds from different populations.

Kelsall and Burton (1979) also found that identification by mineral profiles was practical for separating subpopulations of birds, but not for separating individuals within collections. Because values vary within and can overlap between subpopulations, there is a need for large samples in order to establish reliable population means. Kelsall and Burton (1979) concluded that with adequate sample sizes and sufficiently different populations, variations due to sex, age, and feather year became unimportant.

Edwards and Smith (1984) showed that trace element profiles could

change within a year when metal ions from the environment are adsorbed onto primaries. Thus, feathers exposed to different environments can attain different mineral profiles. They found, however, that profiles still maintained group affinities. In our work, for instance, the old and new quelea feathers obtained from Somalia had different mineral profiles. Still, the profile of the group was distinctive, even though it differed with the age of the feathers. A change in the profile over time does not negate its utility as long as the profile for the group remains unique.

We concluded that the populations we examined could be differentiated by trace element content of feathers. If profiles for populations of adult birds remain constant or change predictably during the year, this technique could be used to distinguish subpopulations at any place or time. Our results from Somalia show that profiles for a population can change over time. The nature of this change may differ depending on the specific habitats used each year; due to ion adsorption, adults can end up with quite different profiles than those with which they began the year. Further studies will be needed to find out how these factors influence the utility of feather minerals to identify specific populations.

Levels of trace elements were consistently lowest in the feathers of juveniles from Tanzania and in the new feathers of adults from Somalia. In addition, the mineral profiles for these two groups were quite similar. This suggests that new feathers may be somewhat alike in mineral content even though they are grown in different areas. Also, the total levels of minerals in or adhered to feathers seem to increase throughout the year. These aspects also deserve further study.

It may prove possible to identify the breeding areas of birds that cause crop damage by monitoring trace elements in feathers of juvenile birds. This would enable population control efforts to be directed at breeding colonies of birds known to cause damage. Young birds grow their primaries at colonies and all birds, regardless of sex, should acquire similar profiles in feathers. This is the only time that birds of different sexes and ages might be expected to grow all of their primaries while feeding on the same foods in the same area. In young, a post-juvenile moult, which is a complete moult and includes the primaries, begins about 9 weeks after fledging (C. Elliott, pers. comm.). This moult continues over the next 3–4 months (Morel and Bourlière 1955; Ward 1973a). It is during this period that juveniles often move into grain crops and cause damage. Trace element analyses might be useful in determining the origin of young that predictably cause crop damage during the months following dispersal from colonies. Such an approach might be the quickest way to utilize trace element analyses in quelea management. Additional research will be needed to test the feasibility of using mineral profiles to identify specific populations of quelea at different times and places throughout the year.

References

- Abifarin, A. D. (1984). The importance of rice awns in the reduction of bird damage. *West Afr. Rice Dev. Assoc. Tech. Newslet.*, 5, 27-8.
- Abramson, M. (1979). Vigilance as a factor influencing flock formation among curlews *Nimenuus arquata*. *Ibis*, 121, 213-6.
- Adesiyun, A. A. (1973). Bird damage to cereals grown in the dry season in some parts of northern Nigeria. *Samaru Agric. Newslet.*, 15, 34-7.
- Agren, G. and Gibson, R. (1968). *Food composition table for use in Ethiopia*. Swedish Int. Dev. Auth./Ethiopian Ministry of Health, Addis Ababa.
- Alcock, J. (1973). Cues used in searching for food by red-winged blackbirds (*Agelaius phoeniceus*). *Behaviour*, 46, 174-87.
- Ah, S. and Ripley, S. D. (1969). *Handbook of the birds of India and Pakistan*, Vol. 3. Oxford University Press, Bombay.
- Allan, R. (1983). The strategy for protecting crops from the depredations of quelea birds in Kenya. *Proc. 9th Bird Control Semin.*, Bowling Green, Ohio, 9, 307-16.
- Allan, R. G. (1975). Assessment of bird damage to irrigated wheat in Sudan. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055, FAO, Rome.
- Allan, R. G. (1980). Quantitative and qualitative assessment of bird damage. *Proc. 2nd Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- Alsager, D. E. (1976). The role of private consultants in vertebrate pest problems in Canada. *Proc. 7th Vertebr. Pest Conf.*, Monterey, California, 7, 26-34.
- Ankney, C. D. and Scott, D. M. (1980). Changes in nutrient reserves and diet of breeding brown-headed cowbirds. *Auk*, 97, 684-96.
- Anonymous (Undated). Report of a preliminary survey of vertebrate pest damage in the Northwest Frontier Province, Pakistan. Unpubl. Rep.
- Anonymous (1954). La lutte contre les oiseaux grignoteurs au Sénégal et en Mauritanie. *Protection des Végétaux*, Dakar.
- Anonymous (1979). FAO crop protection manual, African grain-eating birds. Unpubl. Internal Rep., FAO/UNDP, Rome, Italy.
- Armstrong, W. D., Rogler, J. C., and Featherston, W. R. (1974). Effect of tannin extraction on the performance of chicks fed bird resistant sorghum grain diets. *Poult. Sci.*, 53, 714-20.
- Ash, J. S. (1981). Qualitative and quantitative assessment of bird pests in Eastern Africa: Somalia. *Proc. 3rd Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- Ash, J. S. and Mistell, J. E. (1983). Birds of Somalia their habitat status and distribution. *Scopus Special Suppl.*, No. 1.
- Ashion, H. (1957). Sixth ringing report. *Ostrich*, 28, 98-115.
- Asquith, T. N., Izuno, C. C., and Butler, L. G. (1983). Characterization of the condensed tannin (proanthocyanidin) from a group II sorghum. *J. Agric. Food Chem.*, 31, 1299-303.

- Attwell, R.I.G. (1954). Crocodiles feeding on weaver birds. *Ibis*, **96**, 485-6.
- Avery, M. L. (1979). Food preferences and damage levels of some avian rice field pests in Malaysia. *Proc. 8th Bird Control Semin.*, Bowling Green, Ohio, **8**, 161-6.
- Barnard, C. J. (1980). Flock feeding and time budgets in the house sparrow (*Passer domesticus* L.). *Anim. Behav.*, **28**, 295-309.
- Barré, M. H. (1983). Quelea movement patterns in Somalia (April 1982- April 1983). *Proc. 4th Annu. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/81/023, pp. 40-4.
- Barré, N. (1973). Incidence de la suppression d'un des parents sur le devenir de la couvée chez *Quelea quelea* (L.). Effectivité de la lutte chimique. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055, FAO, Rome.
- Bashir, E. A. (1978). Review of parakeet damage in Pakistan and suggested control methods. *Proc. Semin. Bird Pest Problems in Agric.*, July 5-6, 1978, Karachi, Pakistan, pp. 22-7.
- Bashir, E. A. (1979). A new 'parotrap' adapted from the MAC trap for capturing live parakeets in the field. *Proc. 8th Bird Control Semin.*, Bowling Green, Ohio, **8**, 167-71.
- Bashir, E. A. (1983). An assessment of bird pest problems to rice in Liberia. Unpubl. Internal Rep., FAO/UNDP Project RAF/81/022, Dakar, Senegal.
- Bashir, E. A. (1984). The ecology of birds and their damage to rice in Liberia. *West Afr. Rice Dev. Assoc. Tech. Newslet.*, **5**, 9-12.
- Bayer, R. D. (1982). How important are bird colonies as information centers? *Auk*, **99**, 31-40.
- Beesley, J.S.S. (1978). Extension of Botswana bird pest research project 1976-1978. Ministry of Overseas Dev./Govt. of Botswana ODM Research Scheme R.2664.
- Benson, C. W. and Benson, F. M. (1977). *The birds of Malawi*. Montfort Press, Limbe.
- Benson, C. W., Brooke, R. K., Dowsett, R. J., and Irwin, M.P.S. (1973). *The birds of Zambia*, 2nd edn. Collins, London.
- Beri, Y. P., Jotwani, M. G., Misra, S. S., and Chander, D. (1969). Studies on relative bird damage to different experimental hybrids of bajra. *Indian J. Entomol.*, **30**, 69-71.
- Bertram, B. C. (1978). Living in groups: predators and prey. In *Behavioural ecology* (eds. J. R. Krebs and N. B. Davies). Blackwell Scientific Publishers, Oxford.
- Besser, J. (1971). Syllabus. Unpubl. Rep., Denver Wildlife Research Center, Denver, Colorado.
- Besser, J. (1973). Protecting seeded rice from blackbirds with methiocarb. *Int. Rice Comm. Newslett.*, **22**, 9-14.
- Besser, J. (1978). Improvements in the use of 4-aminopyridine for protecting agricultural crops from birds. *Proc. 8th Veretr. Pest Conf.*, Sacramento, California, **8**, 51-3.
- Besser, J. F., Berg, W. J., and Knittle, C. E. (1979). Late-summer feeding patterns of red-winged blackbirds in a sunflower-growing area of North Dakota. *Proc. 8th Bird Control Semin.*, Bowling Green, Ohio, **8**, 209-14.
- Bille, J.-C. (1976). Etude de la production primaire nette d'un écosystème saharien. Travaux et documents de l'ORSTOM, Nr. 65, ORSTOM, Paris.
- Blem, A. R., Ames, R. B., Liaw, C. S., and Pryzbylek, J. M. (1983). Effect of preharvest application of Dimethipin on grain moisture, milling quality and yield of rice. *Proc. 10th Annu. Meet. Plant Growth Regul. Soc. America*, pp. 241-7.
- Blessin, C. W., Anderson, R. A., Deathrage, W. L., and Inglett, G. E. (1971). Effect of alkali dehulling on composition and wet-milling characteristics of sorghum grain. *Cereal Chem.*, **40**, 528-32.
- Boequet, C. and Roy, J. (1953). Lutte antiaviaire rapport de mission. *Protection des Végétaux*, Dakar.
- Bortoli, L. (1970). Rapport de campagne-nidification 1970. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055, FAO, Rome.
- Bortoli, L. (1974a). Mission en Haute Volta - du 4 au 11 juin 1974. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055, FAO, Rome.
- Bortoli, L. (1974b). Nidification des principales espèces d'oiseaux granivores au Mali en 1974. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055, FAO, Rome.
- Bortoli, L. (1975). Rapport sur la nidification de *Quelea quelea* dans le delta intérieur du Niger et les régions adjacentes en 1975. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055, FAO, Rome.
- Bortoli, L. (1978). Traditional crop protection methods. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055, FAO, Rome.
- Bortoli, L. and Bruggers, R. L. (1976). Dégâts d'oiseaux sur sorgo de decret dans La Vallée du Sénégal. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055, FAO, Rome.
- Bortoli, L. and Jackson, J. (1972). The distribution of races of *Quelea quelea* in the project area. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055, FAO, Rome.
- Bouchardieu, A. and Lefèvre, L. (1965). Monographie du Lac Tchad. ORSTOM, Paris.
- Boudet, G. (1975). Manuel sur les paturages tropicaux et les cultures fourragères. Ministère de la Coopération, Paris, IEMVT, Maisons-Alfort.
- Boudreau, G. W. (1975). *How to win the war with pest birds*. Wildlife Technology, Hollister, California.
- Bray, O. E. (1973). Radiotelemetry for studying problem birds. *Proc. 6th Bird Control Semin.*, Bowling Green, Ohio, **6**, 198-200.
- Bray, O. E., Knittle, C. E., Jack, J. R., and Bowman, R. L. (1978). Locating and identifying blackbird-starling roosts by multispectral remote sensing. *Sci. Tech. Ser. Natn. Wildl. Fed.*, **3**, 194-6.
- Bray, O. E., Larsen, K. H., and Mott, D. F. (1975). Winter movements and activities of radio-equipped starlings. *J. Wildl. Manage.*, **39**, 795-801.
- Bremner, H., Cisse, A. M., Djiteye, M. A., and Elbersse, W. Th. (1982). Le potentiel botanique des paturages. In *La productivité des paturages sahariens* (eds. F.W.T. Penning De Vries and M. A. Djiteye). Centre for Agricultural Publishing and Documentation, Wageningen, pp. 98-132.
- Brooke, C. (1967). The heritage of famine in central Tanzania. *Tanzania Notes Rec.*, **67**, 15-22.
- Brown, L. H. and Britton, P. L. (1980). *The breeding seasons of East African birds*. East African Natural History Society, Nairobi.

- Brown, L. H., Urban, E. K., and Newman, K. (1982). *The birds of Africa*, Vol. 1. Academic Press, London, UK.
- Bruggers, R., Ellis, J., Sedgwick, J., and Bourassa, J. (1981a). A radio transmitter for monitoring the movements of small passerine birds. *Proc. 3rd Int. Conf. Wildl. Biotelem.*, Laramie, Wyoming, **3**, 69–79.
- Bruggers, R., Malice, J., Erickson, W., Jaeger, M., Jackson, W. B., and Juimale, Y. (1981b). Reduction of bird damage to field crops in eastern Africa with methiocarb. *Trop. Pest Manage.*, **27**, 230–41.
- Bruggers, R. L. (1979a). Evaluating Curb as a crop repellent to West African bird pests. In *Vertebrate pest control and management materials*. ASTM STP 680 (ed. J. R. Beck). Am. Soc. for Testing and Materials, pp. 188–97.
- Bruggers, R. L. (1979b). Summary of methiocarb trials against pest birds in Senegal. *Proc. 8th Bird Control Semin.*, Bowling Green, Ohio, **8**, 172–84.
- Bruggers, R. L. (1980). The situation of grain-eating birds in Somalia. *Proc. 9th Vertebr. Pest Conf.*, Fresno, California, **9**, 5–16.
- Bruggers, R. L. (1982). The exportation of cage birds from Senegal. *Tropic. Bull. IV*, 12–22. Wildlife Trade Monitoring Unit, IUCN Conservation Monitoring Centre, Cambridge, UK.
- Bruggers, R. L., Bohl, W. H., Bashir, S. El, Hamza, M., Ali, B., Besser, J. F., De Grazio, J. W., and Jackson, J. J. (1984a). Bird damage to agriculture and crop protection efforts in the Sudan. *FAO Plant Protect. Bull.*, **32**, 2–16.
- Bruggers, R. L. and Bortoli, L. (1979). Laboratory trials using fluorescent dyes and paints as marking agents for quelea studies. In *Vertebrate pest control and management materials*, ASTM STP 680 (ed. J. R. Beck). Am. Soc. for Testing and Materials, pp. 231–6.
- Bruggers, R. L. and Jackson, W. B. (1981). Suggested methods for determining the efficacy of vertebrate control agents in developing countries. In *Vertebrate pest control and management materials*, ASTM STP 752 (eds. E. W. Schafer, Jr. and C. R. Walker). Am. Soc. for Testing and Materials, pp. 15–28.
- Bruggers, R. L., Jaeger, M. E., and Jaeger, M. M. (1985). Tisserins gendarmes (*Ploceus cucullatus abyssinicus*) et tisserins masqués (*Placens intermedius intermedius*) munis d'émetteurs radio et de rubans dans une colonie de nidification du sud de l'Ethiopie. *Oiseau Rev. Fr. Ornithol.*, **55**, 81–92.
- Bruggers, R. L. and Jaeger, M. M. (1982). Bird pests and crop protection strategies for cereals of the semi-arid African tropics. In *Sorghum in the Eighties: Proc. Int. Symp. on Sorghum* (ed. J. Mertin), ICRISAT, Patancheru, A. P., India, pp. 303–12.
- Bruggers, R. L., Jaeger, M. M., and Bourassa, J. B., Latigo, A. A., and Gillis, J. N. (In press). Impact of fenthion sprays on nontarget birds during quelea control in Kenya. *Wildl. Soc. Bull.*
- Bruggers, R. L., Murshid, A. A., and Miskell, J. (1981c). Accidental death of red-billed queleas roosting in lemon trees in Somalia. *Ostrich* **52**, 60–2.
- Bruggers, R. L. and Ruelle, P. (1977). Bird losses in Senegal rice significantly cut. *Rice J.*, Nov/Dec, pp. 10–4.
- Bruggers, R. L. and Ruelle, P. (1981). Economic impact of pest birds on ripening cereals in Senegal. *Protect. Ecol.*, **3**, 7–16.
- Bruggers, R. L. and Ruelle, P. (1982). Efficacy of nets and fibres for protecting crops from grain-eating birds in Africa. *Crop Protect.*, **1**, 55–65.
- Bruggers, R. L., Sultana, P., Brooks, J. E., Fiedler, L. A., Rimpel, M., Manikowski, S., Shivanaryan, N., Santhiath, N., and Okuno, I. (1984b). Preliminary investigations of the effectiveness of trimethacarb as a bird repellent in developing countries. *Proc. 11th Vertebr. Pest Conf.*, Sacramento, California, **11**, 192–203.
- Brunel, J. and Thiolay, J. M. (1969). Liste préliminaire des oiseaux de Côte-d'Ivoire. *Afriques*, **37**, 230–54.
- Bullard, R. W. (1979). New developments in bird resistant sorghums. *Proc. 8th Bird Control Semin.*, Bowling Green, Ohio, **8**, 229–34.
- Bullard, R. W., Bruggers, R. L., Kilburn, S. R., and Fiedler, L. A. (1983c). Sensory-cue enhancement of the bird repellency of methiocarb. *Crop Protect.*, **2**, 387–9.
- Bullard, R. W. and Elias, D. J. (1980). Sorghum polyphenols and bird resistance. In *Polyphenols in cereals and legumes*, *Proc. 36th Annu. Meet. Inst. Food Technol.* (ed. J. H. Hulse), Ottawa, Canada, Int. Dev. Res. Centre Publ. IDRC-145c, pp. 43–9.
- Bullard, R. W., Garrison, M. V., Kilburn, S. R., and York, J. O. (1980). Laboratory comparisons of polyphenols and their repellent characteristics in bird-resistant sorghum grains. *J. Agric. Food Chem.*, **28**, 1006–11.
- Bullard, R. W., Schafer, E. W., Jr., and Bruggers, R. L. (1983a). Tests of the enhancement of avian repellent chemicals with sensory cues. In *Vertebrate pest control and management materials*, *ASTM STP 817* (ed. D. E. Kaukinen). Am. Soc. for Testing and Materials, pp. 66–75.
- Bullard, R. W. and Shumake, S. A. (1979). Two-choice preference testing of taste repellency in *Quielea quelea*. In *Vertebrate pest control and management materials*, *ASTM STP 680* (ed. J. R. Beck). Am. Soc. for Testing and Materials, pp. 178–87.
- Bullard, R. W. and York, J. O. (1985). Breeding for bird resistance in sorghum and maize. In *Plant breeding programs reviews* (ed. G. E. Russell). Butterworths, Surrey, England, pp. 193–222.
- Bullard, R. W., York, J. O., and Kilburn, S. R. (1981). Polyphenolic changes in ripening bird-resistant sorghums. *J. Agric. Food Chem.*, **29**, 973–81.
- Bullard, R. W., Zeineldin, M. H., and Jackson, W. B. (1983b). Repellent potential of vegetable tannins on *Quielea quelea*. *Proc. 9th Bird Control Semin.*, Bowling Green, Ohio, **9**, 233–9.
- Busnel, R. G. and Grosmaire, P. (1958). Enquête auprès des populations du fleuve Sénégal sur leur méthode acoustique de lutte traditionnelle contre le Quelea. *Bull. I.F.A.N.*, **20**, 623–33.
- Calvi, C., Besser, J. F., De Grazio, J. W., and Mott, D. F. (1976). Protecting Uruguayan crops from bird damage with methiocarb and 4-aminopyridine. *Proc. 7th Bird Control Semin.*, Bowling Green, Ohio, **7**, 255–8.
- Campbell, B. and Lack, E. (eds.) (1985). *A dictionary of birds*. BOU/Poyser, Calton, England.

- Capretta, P. J. (1961). An experimental modification of food preferences in chicks. *J. Comp. Physiol. Psychol.*, **54**, 238-42.
- Caraco, T. (1979). Time budgeting and group size: a theory. *Evolving*, **60**, 611-7.
- Caraco, T., Martindale, S., and Pulliam, H. R. (1980). Avian flocking in the presence of a predator. *Nature*, **285**, 400-1.
- Caughley, G. (1977). *Analysis of vertebrate populations*. Wiley, Chichester.
- Clecke, R. A. and Walsh, J. F. (1980). Bird records from the Republic of Togo. *Malimbus*, **2**, 112-20.
- Chen, P. Y. and Li, Y. (1980). The effect of wheat awns on grain weight and their physiological function. *Acta Agron.*, **7**, 279-83.
- Church, B. M. (1971). The place of sample survey in crop loss estimation. In *Crop loss assessment methods*, FAO manual on the evaluation and prevention of losses by pests, disease and weeds (ed. L. Chiarappa), pp. 2.2/1-2.2/8.
- Cisse, A. M. and Breman, H. (1982). La phytoécologie de Sahel et du terrain d'étude. In *La productivité des plaines Sahéliennes* (eds. F. W. T. Penning, De Vries and M. A. Djiteye). Centre for Agricultural Publishing and Documentation, Wageningen, pp. 71-83.
- Cisse, B. (1981). Lutte chimique contre le quelea (*Unguiculus*) en Afrique de l'Ouest. Unpubl. Ph.D. Thesis, Univ. of Dakar, Faculty of Medicine and Pharmacy, Dakar, Senegal.
- Clancey, P. A. (1960). A new race of red-billed quelea from southeastern Africa. *Bull. Br. Ornithol. Club*, **80**, 67-8.
- Clancey, P. A. (1968). Subspeciation in some birds from Rhodesia II. *Durban Mus. Novit.*, **8**, 153-82.
- Clancey, P. A. (1973). The subspecies of the *haemorrhous*-group of *Querula querula* (Linnaeus). *Durban Mus. Novit.*, **10**, 13-22.
- Cochran, W. G. (1977). *Sampling techniques*. 3rd edn. Wiley, New York.
- Collias, N. E. and Collias, E. C. (1970). The behaviour of the west African village weaverbird. *Ibis*, **112**, 457-80.
- Collias, N. E. and Collias, E. C. (1971). Ecology and behaviour of the spotted-backed weaverbird in the Kruger National Park. *Koedoe*, **14**, 1-27.
- Collar, N. J. and Stuart, S. N. (1985). *Threatened birds of Africa and related islands*. Int. Council for Bird Preservation and Int. Union for Conservation of Nature and Natural Resources, Cambridge, UK.
- COPR. (1975). The problem of damage to sorghum by doves in Botswana, 1972-1974 Report. Unpubl. Int. Rep., Centre for Overseas Pest Research, London, UK.
- COPR. (1976). Bird pest research project, Botswana - Final Rep. 1972-1975. Centre for Overseas Pest Research, London, UK.
- COPR. (1977). Quelea investigations project, Nigeria. Final Rep. 1972-1975. Ministry of Overseas Dev./Fed. Military Govt., Nigeria.
- Crase, F. T. and DeHaven, R. W. (1976). Methiocarb: its current status as a bird repellent. *Proc. 7th Vertebr. Pest Conf.*, Monterey, California, **7**, 46-50.
- Crase, F. T. and DeHaven, R. W. (1978). Food selection by five sympatric California blackbird species. *Calif. Fish Game*, **64**, 255-67.
- Crocker, J. (1984). How to build a better scarecrow. *New Scientist*, **1403**, 10-2.
- Crook, J. H. (1960). Studies on the social behaviour of *Querula quera* (Linn.) in French West Africa. *Behaviour*, **16**, 1-55.
- Crook, J. H. (1962). The adaptive significance of pair formation types in weaver birds. *Symp. Zool. Soc. Lond.*, **8**, 57-70.
- Crook, J. H. (1964). The evolution of social organization and visual communication in the weaver birds (Ploceinae). *Behaviour / Suppl.*, **10**, 1-178.
- Crook, J. H. and Butterfield, P. A. (1970). Gender role in the social system of quelea. In *Social behaviour in birds and mammals* (ed. J. H. Crook). Academic Press, London, pp. 211-48.
- Crook, J. H. and Ward, P. (1968). The quelea problem in Africa. In *The problems of birds as pests* (eds. R. K. Murton and E. N. Wright). Academic Press, London, pp. 211-29.
- Curtis, D. L. (1965). Sorghum in West Africa. *Samara Res. Bull.*, **59**. Nigeria.
- Curtis, D. L. (1968). The relation between the date of heading of Nigerian sorghums and the duration of the growing season. *J. Appl. Ecol.*, **5**, 215-26.
- Czaplicki, J. A., Borreback, D. E., and Wilcox, H. C. (1976). Stimulus generalization of an illness-induced aversion to different intensities of colored water in Japanese Quail. *Anim. Learn. Behav.*, **4**, 45-8.
- Da Camara-Smeets, M. (1977). Les dégâts d'oiseaux au berbéré au Tchad et au Nord-Cameroun. *Agron. Trop.*, **XXXII** 3, 262-78.
- Da Camara-Smeets, M. and Affoyon, D. (1980). Mission de reconnaissance des oiseaux granoires dépredateurs au sud-Cameroun II. Unpubl. Internal Rep., FAO/UNDP Project RAF/77/047, FAO, Rome.
- Da Camara-Smeets, M. and Manikowski, S. (1979). Repères visuels utilisés par *Querula querula* et *Ploceus cucullatus* dans leurs choix alimentaires. *Malimbus*, **1**, 127-34.
- Dar, C. (1974). *Summary of trials with CURB on cultivated vegetables and fruit from sowing to harvest*. Assiamaibarot Ltd., Israel.
- Davies, N. B. (1977). Prey selection and the search strategy of the spotted flycatcher (*Muscicapa striata*): a field study on optimal foraging. *Anim. Behav.*, **25**, 1016-33.
- Dawson, D. G. (1970). Estimation of grain loss to sparrows (*Passer domesticus*) in New Zealand. *N.Z. J. Agric. Res.*, **13**, 681-8.
- De Grazio, J. W. (1978). World bird damage problems. *Proc. 8th Vertebr. Pest Conf.*, Sacramento, California, **8**, 9-24.
- De Grazio, J. W. (Compiler) (1984). Progress of vertebrate pest management in agriculture, 1966-1982. Unpubl. USAID/DWRC Rep., Denver Wildlife Research Center, Denver, Colorado.
- De Grazio, J. W. and Besser, J. F. (1970). Bird damage problems in Latin America. *Proc. 4th Vertebr. Pest Conf.*, Davis, California, **4**, 162-7.
- De Grazio, J. W., Besser, J., and Schafer, E., Jr. (1971). Unpubl. Annu. Rep., Denver Wildlife Research Center, Denver, Colorado.
- De Grazio, J. W. and Shumake, S. A. (1982). Controlling quelea damage to small grains in Africa with methiocarb. In *Alternative strategies for desert development and management*, Vol. 2. Proc. UNITAR Int. Conf., Sacramento, California, 1977. Pergamon Press, New York, pp. 452-6.

- De Groot, P. (1980). Information transfer in a socially roosting weaver bird (*Querquedula ploceoides*: Ploceinae): an experimental study. *Anim. Behav.*, **28**, 1249–54.
- Dekeyser, P. L. (1958). Recherches sur la biologie du travailleur à bec rouge (*Querquedula Latham*). In *Réunion de spécialistes sur les Querquedula*. Dakar, 31 October–6 November 1955. CCTA/CSA Joint Secretariat, London, pp. 1–8.
- Devine, T. and Peterle, T. J. (1968). Possible differentiation of natal areas of North American waterfowl by neutron activation analysis. *J. Wildl. Manage.*, **32**, 274–9.
- Dhindsa, M. S. and Toor, H. S. (1980). Extent of bird damage to rice nurseries in the Punjab and its control. *India J. Agric. Sci.*, **50**, 715–9.
- Disney, H. J. de S. (1957). *Querquedula in Tanganyika. Cage experiments*. CCTA/CSA Africa (57)QB13. CSA Symposium on *Querquedula*. Livingston, 1957. CCTA/CSA Joint Secretariat, Bukavu.
- Disney, H. J. de S. (1960). Ringing and marking of quelea in Tanganyika. CCTA/CSA Quelea (60)9. CCTA/FAO Symposia on *Querquedula*. Bamako, CCTA/CSA Publ. **58**, 143–9.
- Disney, H. J. de S. (1964). Quelea control. In *A new dictionary of birds* (ed. A. Landsborough Thomson). Nelson, London and Edinburgh, pp. 673–4.
- Disney, H. J. de S. and Haylock, J. W. (1956). The distribution and breeding behaviour of the Sudan dioch (*Querquedula q. aethiopica*) in Tanganyika. *East Afr. Agric. J.*, **21**, 141–7.
- Disney, H. J. de S., Loftis, B., and Marshall, A. J. (1959). Duration of the regeneration period of the internal reproductive rhythm in a xerophilous equatorial bird *Querquedula quelea*. *Nature (Lond.)*, **184**, 1659–60.
- Disney, H. J. de S., Loftis, B., and Marshall, A. J. (1961). An experimental study of the internal rhythm of reproduction in the red-billed dioch *Querquedula quelea* by means of photo-stimulation, with a note on melanism induced in captivity. *Proc. Zool. Soc. Lond.*, **136**, 123–9.
- Disney, H. J. de S. and Marshall, A. J. (1956). A contribution to the breeding biology of the weaver-finch *Querquedula quelea* (Linnaeus) in East Africa. *Proc. Zool. Soc. Lond.*, **127**, 379–87.
- Doggett, H. (1957). Bird-resistance in sorghum and the quelea problem. *Field Crop Abstracts*, **10**, 153–6.
- Doggett, H. (1970). *Sorghum*. Longmans Green and Co. Ltd., London, UK.
- Doggett, H. (1982). Factors reducing sorghum yields *Striga* and birds. In *Sorghum in Africa*. In *Sorghum production and utilization* (eds. J. S. Wall and W. M. Ross). AVI Publishing Company, Inc., Westport, Connecticut, pp. 288–326.
- Dolbeer, R. A. (1980). Blackbirds and corn in Ohio. *U.S. Fish Wildl. Serv. Resour. Publ.*, **136**.
- Dolbeer, R. A., Stickley, A. R., and Woronecki, P. P. (1978). Starling *Sturnus vulgaris* damage to sprouting wheat in Tennessee and Kentucky. U.S.A. *Protect. Ecol.*, **1**, 159–69.
- Dolbeer, R. A., Woronecki, P. P., and Stehn, R. A. (1984). Blackbird (*Agelaius phoeniceus*) damage to maize: crop phenology and hybrid resistance. *Protect. Ecol.*, **7**, 43–63.
- Dorow, E. (1973). Grunddaten und Überlegungen zum Einsatz einer wirkungsvollen Sprühhausstruktur für die Alt Vogelbekämpfung im Nisiplatz. Unpubl. Internal Rep., GAWI, Frankfurt, West Germany.
- Drees, E. M. (1980). Bird pests in agriculture in West Africa and their control. Unpubl. Internal Rep., Wageningen Agric. Univ. Naturbrecheer.
- Dunbar, R. J. M. and Crook, J. H. (1975). Aggression and dominance in the weaver bird, *Querquedula quelea*. *Anim. Behav.*, **23**, 450–9.
- Duncan, R. R. (1980). Methiocarb as a bird repellent on ripening grain sorghum. *Can. J. Plant Sci.*, **60**, 1129–33.
- Dunnet, G. M. and Patterson, I. J. (1968). The rook problem in North-east Scotland. In *The problems of birds as pests* (eds. R. K. Murton and E. N. Wright). Academic Press, London, pp. 119–39.
- DWRC. (1978). Vertebrate damage control research in agriculture. Unpubl. Annu. Rep., Denver Wildlife Research Center.
- Dyer, M. I. and Ward, P. (1977). Management of pest situations. In *Granivorous birds in ecosystems* (eds. J. Pinowski and S.C. Kendeigh). Cambridge University Press, Cambridge, pp. 267–300.
- Eastman, P. (1980). An end to pounding: a new mechanical flour milling system in use in Africa. Monograph. IDRC-152C, Int. Dev. Res. Centre, Ottawa, Canada.
- Edwards, W. R. and Smith, K. E. (1984). Exploratory experiments on the stability of mineral profiles of feathers. *J. Wildl. Manage.*, **48**, 853–66.
- Elgood, J. H., Fry, C. H., and Dowsett, R. J. (1973). African migrants in Nigeria. *Ibis*, **115**, 375–411.
- Elias, D. (1977). Vertebrate pests in Latin American agriculture. Unpubl. Internal Rep., Denver Wildlife Research Center, Denver, Colorado.
- Elliott, C. C.H. (1979). The harvest time method as a means of avoiding quelea damage to irrigated rice in Chad/Cameroun. *J. Appl. Ecol.*, **16**, 23–35.
- Elliott, C. C.H. (1980a). Monitoring and research in *Querquedula intermedia*. *Min. 2nd Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- Elliott, C. C.H. (1980b). Sex ratio in two ploceids. *Acta 17th Congr. Int. Ornithol.*, Berlin, (ed. R. Nöhring), pp. 1359–60.
- Elliott, C. C.H. (1980c). A regional quelea survey/spray helicopter service for Eastern Africa. *Min. 2nd Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- Elliott, C. C.H. (1981a). Monitoring of *Querquedula quelea* in eastern Africa - Part II. The relationship between quelea breeding and rainfall: Quelea moult studies. *Proc. 3rd Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042, pp. 35–42.
- Elliott, C. C.H. (1981b). Methods for assessing the efficiency of aerial spraying control operations on quelea colonies and roosts. In *Vertebrate pest control and management materials*. ASTM STP 752 (eds. E. W. Schafer, Jr. and C. R. Walker). Am. Soc. for Testing and Materials, pp. 62–73.
- Elliott, C. C.H. (1981c). Overview of bird pest problems in Eastern Africa. *Proc. 3rd Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- Elliott, C. C.H. (1983a). The quelea bird as a pest of wheat in eastern and southern

- African. *Proc. Regional Wheat Workshop East, Central and Southern Africa*. Arusha, Tanzania. Nakuru Press, Kenya. pp. 140-6.
- Elliott, C.C.H. (1983b). Quelea movement patterns at the national level - Tanzania. *Proc. 4th Annu. Tech. Meet., FAO/UNDP Regional Quelea Project* RAF/81/023.
- Elliott, C.C.H. (In press). The quelea as a major problem in a food-deficient continent. In *The quelea problem in southern Africa* (eds. P. J. Mundy and M.J.F. Jarvis). Baobab Books, Zimbabwe.
- Elliott, C.C.H. and Beesly, J.S.S. (1980). Bird damage to cereal crops - Tanzania 1980. *Proc. 2nd Annu. Tech. Meet., FAO/UNDP Regional Quelea Project* RAF/77/042.
- Elliott, C.C.H. and Jarvis, M.J.F. (1970). Fourteenth ringing report. *Ostrich*, 41, 1-17.
- Elliott, C.C.H. and Jarvis, M.J.F. (1972-1973). Fifteenth ringing report. *Ostrich*, 43, 236-95; 44, 34-78.
- Elliott, C.C.H. and Manikowski, S. (1976). A review of scouting methods used during the 1976 bird-control campaign in Chad/Cameroun and proposals for their improvement. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055, FAO, Rome.
- Elnahdi, E. M. (1982). Sensory cue enhancement of methiocarb repellency to the African weaver-finch (*Quelea quelea*). Unpubl. M.S. thesis, Bowling Green State University, Bowling Green, Ohio.
- Elnahdi, E. M., Bullard, R. W., and Jackson, W. B. (1985). Calcium carbonate enhancement of methiocarb repellency for quelea. *Trop. Pest Manage.*, 31, 67-72.
- Emulen, S. T. and Demong, N. J. (1975). Adaptive significance of synchronized breeding in a colonial bird. *Science*, 188, 1029-31.
- Endler, J. A. (1977). *Geographic variation, speciation, and clines*. Princeton University Press, Princeton.
- Erickson, W. A. (1979). Diets of the red-billed quelea (*Quelea quelea*) in the Awash River Basin of Ethiopia. *Proc. 8th Bird Control Seminar*, Bowling Green, Ohio, 8, 185-200.
- Erickson, W. A. (1984). Diets of five weaverbird species (Ploceidae) in the Awash River Valley of Ethiopia. Unpubl. M.S. thesis, Bowling Green State University, Bowling Green, Ohio.
- Erickson, W. A. and Damena, A. (1982). Breeding of red-billed queleas (*Quelea quelea*) in relation to rainfall patterns in Ethiopia. Unpubl. Internal Rep., FAO/UNDP Quelea Project ETH/77/022, FAO, Rome.
- Erickson, W. A., Jaeger, M. M., and Brugers, R. L. (1980). The development of methiocarb for protecting sorghum from birds in Ethiopia. *Ethiop. J. Agric. Sci.*, 2, 91-100.
- Evans, J. and Griffith, R. E., Jr. (1973). A fluorescent tracer and marker for animal studies. *J. Wildl. Manage.*, 37, 73-81.
- Ewing, K., Crabb, A. C., Martin, L. R., and Moitoso, R. (1976). Preliminary laboratory and field trials of Curb, a possible avian repellent. *Proc. 7th Bird Control Seminar*, Bowling Green, Ohio, 7, 239-41.
- Fahlund, L. A. (1965). Report of the United States observer to the Food and Agriculture Organization of the United Nations. *Conf. on Quelea, Bird and Water Hyacinth Control in Africa*. Duala, Cameroon, V, 1-18.
- FAO. (1978). *Bird scold's handbook*. United Nations Dev. Prog./Food and Agricultural Organization.
- FAO. (1979a). *Min. 1st Annu. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- FAO. (1979b). Crop protection manual - African grain-eating birds. FAO/UNDP Publ. AGOA, RAF/73/055.
- FAO. (1980a). Cereal crop pests in Africa, with particular reference to birds. Unpubl. Internal Rep., FAO/UNDP, Rome, Italy.
- FAO. (1980b). *Min. 2nd Annu. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- FAO. (1980c). Coordination of cooperative action to reduce bird damage to crops in eastern Africa. *Min. 2nd Annu. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- FAO. (1981a). An assessment of the bird pest problem in Sudan, Ethiopia, Somalia, Kenya, Tanzania. Unpubl. Internal Rep., FAO/UNDP, Rome, Italy.
- FAO. (1981b). The infrastructure for monitoring quelea in eastern Africa. Unpubl. Internal Rep., FAO/UNDP, Rome, Italy.
- FAO. (1982a). FAO Month. Bull. Stat., 5, 1-68, Food and Agriculture Organization of the United Nations, Rome, Italy.
- FAO. (1982b). Regional technical assistance to OCLALAV for crop protection against grain-eating birds: conclusions and recommendations of the project. Final Report AG:DP/RAF/77/047, FAO/UNDP, Rome.
- FAO. (1984a). Agroclimatological data for Africa. Unpubl. Internal Rep., FAO/UNDP, Rome, Italy.
- FAO. (1984b). *Proc. 5th Annu. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/81/023.
- FAO/WHO. (1980). Pesticide residues in food - 1980; evaluations 1980. Food and Agriculture Organization/World Health Organization, FAO Plant Prod. Project, 26, 218-34.
- Farris, M. A. E. (1975). The general bird problem in grain sorghum. *Proc. Int. Sorghum Workshop* (ed. Publication Staff), U.S. Agency for International Development, Washington, D.C., pp. 289-304.
- Fee, C. (1984). *The starling*. Oxford University Press, Oxford and New York.
- Fee, C. J. (1974). Ecological studies of the rook (*Corvus frugilegus* L.) in North-East Scotland. Damage and its control. *J. Appl. Ecol.*, 11, 897-914.
- Federer, W. T. (1955). *Experimental design: Theory and application*. Oxford and IBH Publ. Co., Calcutta.
- Fitzwater, W. D. (1971). The weaver finch of Hispaniola. *Pest Control*, 39, 19-20; 56-9.
- Fitzwater, W. D. (1973). Madam Saga—an approach to an animal damage problem. *Proc. 6th Bird Control Seminar*, Bowling Green, Ohio, 6, 47-52.
- Fleming, T. H. (1981). Winter roosting and feeding behaviour of pied wagtails *Motacilla alba* near Oxford, England. *Ibis*, 123, 463-76.
- Fogden, M.P.L. (1972). The seasonality and population dynamics of equatorial forest birds in Sarawak. *Ibis*, 114, 307-43.
- Fogden, M.P.L. and Fogden, P. M. (1979). The role of fat and protein reserves in the annual cycle of the Grey-backed camaroptera in Uganda (Aves: Sylvidae). *J. Zool. (Lond.)*, 189, 233-58.

- Froman, B. and Person, S. (1974). *An illustrated guide to the grasses of Ethiopia*. Chilao Agricultural Development Unit, Asella, Ethiopia.
- Fumilayo, O. and Akande, M. (1977). Vertebrate pests of rice in southwestern Nigeria. *PANS*, **23**, 38-48.
- Fuggles-Couchman, N. R. (1952). The destruction of rice-eating birds. *East Afr. Agric. J.*, **19**, 77-8.
- Gadgil, M. (1972). The function of communal roosts: relevance of mixed roosts. *Ibis*, **114**, 531-3.
- Garrison, M. V. and Libay, J. L. (1982). Potential of methiocarb seed treatment for protection of sprouting rice from Philippine bird pests. *Lophura* spp. *Philipp. Agric.*, **65**, 363-6.
- Gaston, A. (1973). Esquisse de reconnaissance des groupements végétaux de la zone de recherches écologiques intensives du projet *Quieula quelea* (Région de N'Djamena). Unpubl. Internal Rep., FAO/UNDP Quieula Project RAF/67/087, FAO, Rome.
- Gaston, A. and Lamarque, G. (1976). Travaux phytosociologiques en relation avec la lutte contre *Quieula quelea*—Bilan de quatre années. Rapport final, FAO/UNDP Regional Quieula Project RAF/67/087. Inst. Elev. Med. Vet. Pays Trop. Maisons Alfort.
- Gaudchau, M. D. (1967). Report on control of the red-billed weaver bird (*Quieula quelea aethiopica*) in the Republic of the Sudan during 1963/65/66/67. Unpubl. Rep., Khartoum, Ministry of Agriculture, Plant Protection Division.
- Ghosh, B. (1945). Efficiency of rectangular plots of different shapes and sizes in field experiments or sample surveys. *Proc. 2nd Indian Sci. Congr.*, Sec. XII, No. 48.
- Gillet, H. (1974). Tapis végétal et paturages du Sahel. In *UNESCO Le Sahel: bases écologiques de l'aménagement*. Notes techniques MAB UNESCO, Paris, pp. 21-7.
- Gillette, K., Irwin, J. D., Thomas, D. K., and Bellingham, W. P. (1980). Transfer of coloured food and water aversions in domestic chicks. *Bird Behav.*, **2**, 37-47.
- Ginn, H. B. and McIlvile, D. S. (1983). *Moult in birds*. British Trust for Ornithology, Guide No. 19.
- Goldstein, J. L. and Swain, T. (1963). Changes in tannins in ripening fruit. *Physiochemistry*, **2**, 371-83.
- Goss-Custard, J. D. (1977). Optimal foraging and the size selection of worms by redshank, *Tringa totanus*, in the field. *Anim. Behav.*, **25**, 10-29.
- Gramet, Ph. (1974). Rapport de mission en République du Mali et du Sénégal du 24/9 au 14/10/74. Unpubl. Internal Rep., FAO/UNDP Quieula Project RAF/73/055, FAO, Rome.
- Grant, C. L. (1953). Spectrographic analysis of ashes of feathers and bones of rufed grouse. Unpubl. Internal Rep., New Hampshire Fish and Game Department, Concord, New Hampshire.
- Gras, G., Hasselman, C., Pellissier, C., and Bruggers, R. (1981). Residue analysis of methiocarb applied to ripening sorghum as a bird repellent in Senegal. *Bull. Environ. Contam. Toxicol.*, **26**, 393-400.
- Grist, D. H. and Lever, R.J.A.W. (1969). *Pests of rice*. Longmans, London, UK.
- Grosmaire, P. (1955). Essai sur l'évolution de la population de *Quieula* dans la vallée du fleuve Sénégal. Variation de cette population depuis Mai 1953 jusqu'au 15 Octobre 1955. Efficacité de la lutte entreprise par l'Organisme de Lutte Anti-aviaire (OLA) du Sénégal. CSA Réunion des Spécialistes du Quieula, Dakar, 1955. Bukavu, Secrétariat Conjoint CCTA/CSA.
- Gruet, C. E., Fleming, W. J., Bushy, D. G., and Hill, E. F. (1983). Assessing hazards of organophosphate pesticides to wildlife. *Proc. North Am. Wildl. Conf.*, **48**, 200.
- Gruet, C. E., Powell, G.V.N., and McChesney, M. J. (1982). Care of nestlings by wild female starlings exposed to an organophosphate pesticide. *J. Appl. Ecol.*, **19**, 327-35.
- GTZ. (1979). Pesticide residue problems in the Third World. Unpubl. Rep., Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, West Germany.
- GTZ. (1982). Die Ökologie und Bekämpfung des Blutschnabelwebervogels [*Quieula quelea* (L.)] in Nordostnigeria. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, West Germany.
- GTZ. (1986). Rotations-Drittspruchanlage. Einsatz- und Bedienungshandbuch. Spec. Publ. No. 186, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, West Germany.
- GTZ. (1987). The ecology and control of the Red-billed Weaver Bird (*Quieula quelea* L.) in Northeast Nigeria. Spec. Publ. No. 199, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, West Germany.
- Guarino, J. L. (1972). Methiocarb, a chemical bird repellent: a review of its effectiveness on crops. *Proc. 5th Vertebr. Pest Conf.*, Fresno, California, 5, 211-6.
- Gupta, R. K. and Haslam, E. (1980). Vegetable tannins—Structure and biosynthesis. In *Polyphenols in cereals and legumes*. Proc. 36th Ann. Meet. Inst. Food Technol. (ed. J. H. Hulse), Ottawa, Canada, Int. Dev. Res. Centre Publ. IDR/C-145c, pp. 15-24.
- Hagerman, A. E. and Butler, L. G. (1980). Condensed tannin purification and characterization of tannin-associated proteins. *J. Agric. Food Chem.*, **28**, 947-52.
- Hailu, K. (1984). Lethal control of red-billed quelea (*Quieula quelea*) in the southern and central Rift Valley during 1983 and 1984 control seasons. *Proc. 5th Ann. Tech. Meet.*, FAO/UNDP Regional Quieula Project RAF/81/023, pp. 102-7.
- Haldane, J.B.S. (1955). The calculation of mortality rates from ringing data. *Proc. Int. Ornithol. Congr.*, **11**, 454-8.
- Hall, B. P. and Moreau, R. E. (1970). *An atlas of speciation in African Passerine birds*. British Museum (Natural History), London, UK.
- Hamza, M., Ali, B., El Haig, I., Bohi, W., Besser, J., De Grazio, J., and Bruggers, R. L. (1982). Evaluating the bird repellency of methiocarb. *Malimbis*, **4**, 33-41.
- Hanson, H. C. and Jones, R. L. (1968). Use of feather minerals as biological tracers to determine the breeding and molting grounds of wild geese. *III. Nat. Hist. Surv. Biol. Notes* **60**.
- Hanson, H. C. and Jones, R. L. (1976). The biogeochemistry of blue, snow and Ross' geese. *III. Nat. Hist. Surv. Spec. Publ.*, **1**.
- Harrel, C. G. and Dirks, B. M. (1955). Cereals and cereal products. In *Handbook of food and agriculture* (ed. F. C. Blank). Reinhold, New York, N.Y., pp. 411-52.
- Harris, H. B. (1969). Bird resistance in grain sorghum. *Proc. 24th Ann. Corn Sorghum Res. Conf.* (eds. J. I. Sutherland and R. J. Falasca). American Seed Trade Association, Washington, D.C., pp. 113-22.

- Hartigan, R. (1979). Sorghum tannins: inheritance, seasonal development, and biological value. Unpubl. M.S. thesis, Purdue Univ., Lafayette, Indiana.
- Haylock, J. W. (1955). *Quela quela*—movements. Unpubl. Rep.: Mostii 25.1.55.
- Haylock, J. W. (1957). Preliminary notes on the Sudan dioch (*Quela quela aethiopica*) and its control by the Department of Agriculture in Kenya Colony. CCTA/CSA Africa (57) QB 12. CSA Symp. Quela, Livingston, 1957. CCTA/CSA Joint Secretariat, Bukavu.
- Haylock, J. W. (1959). *Investigations on the habits of quelea birds and their control*. Nairobi, Government Printers.
- Heckel, J.-U. (1983). GTZ—bird control activities in the Republic of Niger during 1981/82 and future goals. *Proc. 4th Ann. Tech. Meet.*, FAO/UNDP Regional Quela Project RAF/81/023.
- Heisterberg, J. F., Knittle, C. E., Bray, O. E., Mott, D. F., and Besser, J. F. (1984). Movements of radio-instrumented blackbirds and European starlings among winter roosts. *J. Wildl. Manage.*, 48, 203–9.
- Hermann, G. and Kolbe, W. (1971). L'embrouage de la semence avec le Mesurol pour la lutte contre les oiseaux dans les cultures de maïs, compte tenu de la tolérance des variétés et des effets secondaires. *Pflanzenschutz-Nachrichten Bayer*, 24, 290–331.
- Holler, N. R., Naquin, H. P., Lefebvre, P. W., Otis, D. L., and Cunningham, D. J. (1982). Mesurol® for protecting sprouting rice from blackbird damage in Louisiana. *Wildl. Soc. Bull.*, 10, 165–70.
- Holyoak, D. T. (1970). Sex-differences in feeding behaviour and size in the curruion crow. *Ibis*, 112, 397–400.
- Hoogland, J. L. and Sherman, P. W. (1976). Advantages and disadvantages of bank swallows (*Riparia riparia*) coloniality. *Ecol. Monogr.*, 46, 33–58.
- Horn, H. S. (1968). The adaptive significance of colonial nesting in the Brewer's blackbird (*Euphagus cyanocephalus*). *Ecology*, 49, 682–94.
- Hoshino, T. and Duncan, R. R. (1981). Bird damage and tannin content in grain sorghum hybrids under different environments. *Jpn. J. Crop Sci.*, 50, 332–7.
- Howard, W. E., Park, J. S., Shin, Y. M., and Cho, W. S. (1975). Rodent control in Republic of Korea. Inst. Agric. Sci. Office of Rural Development.
- Hudson, R. H., Tucker, R. K., and Haagel, M. A. (1984). Handbook of toxicity of pesticides to wildlife. *USFWS Resour. Publ.* 153.
- Huffnagel, H. P. (1961). *Agriculture in Ethiopia*. Food and Agriculture Organization of the United Nations, Rome, Italy.
- Hulse, J. H., Laing, E. M., and Pearson, O. E. (1980). *Sorghum and the millets: their composition and nutritive value*. Academic Press, London, UK.
- Humphries, D. A. and Driver, P. M. (1970). Protean defence by prey animals. *Oecologia*, 5, 285–302.
- Inglis, I. R. (1980). Visual bird scarers: an ethological approach. *Proc. Bird Problems in Agric. Symp.* (eds. E. N. Wright, I. R. Inglis, and C. J. Feare). University of London, BCPC Publ., pp. 121–43.
- Irwin, M.P.S. (1981). *The birds of Zimbabwe*. Quest Publishing, Harare.
- Jackson, J. (1973). Summary of data on distribution and migration of quelea in the Lake Chad Basin and the Benoue Watershed in Tchad and Cameroons. Unpubl. Internal Rep., FAO/UNDP Quela Project RAF/73/055, FAO, Rome.
- Jackson, J. and Park, P. O. (1973). The toxic effects of fenthion on a nesting population of queleas during experimental control by aerial spraying. *Proc. 6th Bird Control Semin.*, Bowling Green, Ohio, 6, 53–73.
- Jackson, J. J. (1971). A bird resistant millet from South Chad. Unpubl. Internal Rep., FAO/UNDP Quela Project RAF/73/055, FAO, Rome.
- Jackson, J. J. (1974a). Nesting success of *Quela quela* with one parent removed and observations on roosting behavior, with implications for control. *Proc. 6th Verlehr. Pest Conf.*, Anaheim, California, 6, 242–5.
- Jackson, J. J. (1974b). A trap for fledgling *Quela quela*. Unpubl. Internal Rep., FAO/UNDP Quela Project RAF/73/055, FAO, Rome.
- Jackson, J. J. (1974c). The relationship of Quela migrations to cereal crop damage in the Lake Chad basin. *Proc. 6th Verlehr. Pest Conf.*, Anaheim, California, 6, 238–42.
- Jackson, W. B. (1979). Subcommittee on the estimation of bird damage to grain crops. *Min. 1st Ann. Tech. Meet.*, FAO/UNDP Regional Quela Project RAF/77/042.
- Jackson, W. B. and Jackson, S. S. (1977). Estimates of bird depredations to agricultural crops and stored products. Plant Health News!, Colloquium on crop protection against starlings, pigeons, and sparrows. *EPPO Publ. Ser. B*, 84, 33–43.
- Jaeger, M. E. and Jaeger, M. M. (1977). Quela as a resource. Unpubl. Internal Rep., FAO/UNDP Quela Project RAF/73/055, FAO, Rome.
- Jaeger, M. M. (1984). Seasonal distribution and movement patterns of quelea in eastern Africa: A current perspective. *Proc. 5th Ann. Tech. Meet.*, FAO/UNDP Regional Quela Project RAF/81/023.
- Jaeger, M. M., Bruggers, R. L., Johns, B. E., and Erickson, W. A. (1986). Evidence of itinerant breeding of the red-billed quelea *Quela quela* in the Ethiopian Rift Valley. *Ibis*, 128, 469–82.
- Jaeger, M. M., Cunningham, D. J., Bruggers, R. L., and Scott, E. J. (1983). Assessment of methiocarb-impregnated sunflower achenes as bait to repel blackbirds from ripening sunflowers. *Proc. 9th Bird Control Semin.*, Bowling Green, Ohio, 9, 207–24.
- Jaeger, M. M., Elliott, C. C., Lenton, G. M., Allan, R. G., Bashir, S., and Ash, J. S. (1981). Monitoring of *Quela quela* in eastern Africa (July 1978–October 1981). Mask index and the distribution of quelea. *Proc. 3rd Ann. Tech. Meet.*, FAO/UNDP Regional Quela Project RAF/77/042.
- Jaeger, M. M. and Erickson, W. A. (1980). Levels of bird damage to sorghum in the Awash Basin of Ethiopia and the effects of the control of quelea nesting colonies (1976–1979). *Proc. 9th Verlehr. Pest Conf.*, Fresno, California, 9, 21–8.
- Jaeger, M. M. and Erickson, W. A. (1981). Lethal control of quelea nesting colonies in the Awash Valley during 1981. *Proc. 3rd Ann. Tech. Meet.*, FAO/UNDP Regional Quela Project RAF/77/042, pp. 62–63.
- Jaeger, M. M., Erickson, W. A., and Jaeger, M. E. (1979). Sexual segregation of red-billed queleas (*Quela quela*) in the Awash River Basin of Ethiopia. *Auk*, 96, 516–24.
- James, F. C. (1983). Environmental component of morphological differentiation in birds. *Science*, 221, 184–6.

- James, F. C., Engstrom, R. T., Nesmith, C., and Laybourne, R. (1984). Inferences about population movements of red-winged blackbirds from morphological data. *Am. Mus. Nat. Nat.*, **111**, 319–31.
- James, H. W. (1928). The nesting of the southern pink-billed weaver (*Quicca quelea lathami*). *Oologists' Rec.*, **8**, 84–5.
- Jarvis, M.J.F. and LaGrange, M. (In press). Conservation, quelea control, and the trap roost concept. In *The quelea problem in southern Africa* (eds. P. J. Mundy and M.J.F. Jarvis). Baobab Books, Zimbabwe.
- Jarvis, M.J.F. and Vernon, C. J. (In press-a). Food and feeding habits of quelea in southern Africa. In *The quelea problem in southern Africa* (eds. P. J. Mundy and M.J.F. Jarvis). Baobab Books, Zimbabwe.
- Jarvis, M.J.F. and Vernon, C. J. (In press-b). Notes on quelea ecology in southern Africa. In *The quelea problem in southern Africa* (eds. P. J. Mundy and M.J.F. Jarvis). Baobab Books, Zimbabwe.
- Jensen, J. V. and Kirkby, J. (1980). *The birds of The Gambia*. An annotated checklist and guide to localities in the Gambia. Aros Nature Guides, Denmark.
- Jeremiah, H. E. and Parker, J. D. (1985). Health hazard aspects of fenthion residues in quelea birds. Int. Cent. for the Application of Pesticides, Cranfield Institute of Technology, UK.
- Johnston, R. F. (1969). Character variation and adaptation in European sparrows. *Syst. Zool.*, **18**, 206–31.
- Johnston, R. F. and Klitz, W. J. (1977). Variation and evolution in a granivorous bird: the house sparrow. In *Granivorous birds in ecosystems* (eds. J. Pinowski and S. C. Kendal), Cambridge University Press, Cambridge, England, pp. 15–51.
- Jones, P. J. (1972). The status of *Quicca quelea* in Botswana and recommendations for its control. Unpubl. Rep., Centre for Overseas Pest Research, to Government of Botswana, London, UK.
- Jones, P. J. (1976). The utilization of calcareous grit by laying *Quicca quelea*. *Ibis*, **118**, 575–6.
- Jones, P. J. (1980). The annual mortality of *Quicca quelea* in South Africa from ringing recoveries during a period of intensive quelea control. *Proc. Pan-Afr. Ornithol. Congr.*, **4**, 423–7.
- Jones, P. J. (1983). Haematocrit values of breeding red-billed queleas *Quicca quelea* (Aves: Ploceidae) in relation to body condition and thymus activity. *J. Zool. (Lond.)*, **201**, 217–22.
- Jones, P. J. and Pope, G. (1977). Wheat damage by quelea in Zambia. Unpubl. Int. Rep., Centre for Overseas Pest Research, London, UK.
- Jones, P. J. and Ward, P. (1976). The level of reserve protein as the proximate factor controlling the timing of breeding and clutch-size in the red-billed quelea *Quicca quelea*. *Ibis*, **118**, 547–74.
- Jones, P. J. and Ward, P. (1979). A physiological basis for colony desertion by red-billed queleas (*Quicca quelea*). *J. Zool. (Lond.)*, **189**, 1–19.
- Joslyn, M. A. and Goldstein, J. L. (1964). Astringency of fruits and fruit products in relation to phenolic content. *Adv. Food Res.*, **13**, 179–217.
- Jowett, D. (1967). Breeding bird-resistant sorghum in East Africa. *Plant Breeding Abstracts*, **37**, 85.
- Kahlbach, E. R. (1937). Blackbirds and the rice crop on the Gulf coast. *Wildlife Resource Management Leaflet B5–96*. U.S. Bureau of Biological Survey, Washington, D. C.
- Katske, R. F. (1970). Trials to control weaver-birds by non aerial operations in the Sudan. Unpubl. Internal Rep., GAWI, Frankfurt, West Germany; PPD Khar-toum.
- Kelsall, J. P. and Burton, R. (1977). Identification of origins of lesser snow geese by X-ray spectrometry. *Can. J. Zool.*, **55**, 718–32.
- Kelsall, J. P. and Burton, R. (1979). Some problems in identification of origins of lesser snow geese by chemical profiles. *Can. J. Zool.*, **57**, 292–302.
- Kelsall, J. P. and Calaprice, J. R. (1972). Chemical content of waterfowl plumage as a potential diagnostic tool. *J. Wildl. Manage.*, **36**, 1088–97.
- Kelsall, J. P., Fannochuk, W. J. and Burton, R. (1975). Chemical variability in plumage of wild lesser snow geese. *Can. J. Zool.*, **53**, 1369–75.
- Kendall, M. D. (1980). Avian thymus glands: a review. *Dev. Comp. Immunol.*, **4**, 191–210.
- Kendall, M. D. and Ward, P. (1974). Erythropoiesis in an avian thymus. *Nature (Lond.)*, **249**, 366–7.
- Kendall, M. D., Ward, P., and Bacchus, S. (1973). A protein reserve in the Pectoralis major flight muscle of *Quicca quelea*. *Ibis*, **115**, 600–01.
- Kendal, S. C. and West, G. C. (1965). Caloric values of plant seeds eaten by birds. *Ecology*, **46**, 553–5.
- Kenya News Agency. (1985). Fish waste sold. *Kenya Nation*, 26 January 1985.
- Kieser, J. A. and Kieser, G. A. (1978). Birds of the De Aar district. *South. Birds 5*.
- King, J. R. (1973). Energistics of reproduction in birds. In *Breeding biology of birds* (ed. D. S. Farmer). National Academy of Sciences, Washington, D.C., pp. 77–107.
- Kitonyo, F. M. (1981). Indirect control achievements: Kenya (October 1980–October 1981). *Proc. 3rd Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042, pp. 64–70.
- Kitonyo, F. M. (1983). Control achievements of the bird control unit in Kenya 1982/83—KEN/82/003. *Proc. 4th Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/81/023, pp. 56–63.
- Kitonyo, F. M. and Allan, R. G. (1979). Quantitative and qualitative assessment of bird damage in Kenya. *Proc. 1st Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- Klopfer, P. H. (1958). Influence of social interactions on learning rats in birds. *Behaviour*, **14**, 282–99.
- Knittle, C. E. and Guarino, J. L. (1976). A 1974 questionnaire survey of bird damage to ripening grain sorghum in the United States. *Sorghum Newslett.*, **19**, 93–4.
- Knittle, C. E., Linz, G. M., Johns, B. E., Cummings, J. L., Davis, J. E. Jr., and Jaeger, M. M. (1987). Dispersal of male red-winged blackbirds from two spring roosts in central North America. *J. Field Ornithol.*, **58**, 490–8.
- Krebs, J. R. and McCleery, R. H. (1984). Optimization in behavioural ecology. In *Behavioural ecology* (eds. J. R. Krebs and N. B. Davies). Blackwell Scientific Publications, Oxford, England, pp. 91–121.

- Krebs, J. R., Stephens, D. W., and Sutherland, W. J. (1983). Perspectives in optimal foraging. In *Perspectives in ornithology* (eds. A. H. Brush and G. A. Clark, Jr.), Cambridge University Press, Massachusetts, pp. 165-216.
- Lack, D. (1954). *The natural regulation of animal numbers*. Oxford University Press, Oxford, UK.
- Lack, D. (1966). *Population studies of birds*. Clarendon Press, Oxford, UK.
- Lack, D. (1968). *Ecological adaptations for breeding in birds*. Methuen, London, UK.
- LaGrange, M. (In press-a). The effect of rainfall on the numbers of quelea destroyed in Zimbabwe. In *The quelea problem in southern Africa* (eds. P. J. Mundy and M.J.F. Jarvis). Baobab Books, Zimbabwe.
- LaGrange, M. (In press-b). Past and present control methods for quelea in Zimbabwe. In *The quelea problem in southern Africa* (eds. P. J. Mundy and M.J.F. Jarvis). Baobab Books, Zimbabwe.
- Lamarche, B. (1981). Liste commentée des oiseaux du Mali, Part II. *Malimbas*, 3, 73-102.
- Lamm, D. W. (1955). Local migratory movements in southern Mozambique. *Ostrich*, 26, 32-7.
- Lane, A. B. (1984). An inquiry into the response of growers to attacks by insect pests in oilseed rape (*Brassica napus* L.), a relatively new crop in the United Kingdom. *Project. Ecol.*, 7, 73-8.
- Latigo, A. A.R. and Meinzingen, W. (1986). Guided application dose (GAD) for aerial control of quelea (*Quelea quelea*). *Proc. 1st Quelea Tech. Meet.*, Desert Locust Control Organization for Eastern Africa, Nairobi, Kenya.
- Lawlor, D. W., Day, W., and Legg, B. J. (1979). Metabolism of water-stressed barley. *Field Crop Abstracts*, 32, 944.
- Lazarus, J. (1979). The early warning function of flocking in birds: An experimental study with captive quelea. *Anim. Behav.*, 27, 855-65.
- LeClerg, E. L. (1971). Field experiments for assessment of crop losses. In *Crop loss assessment methods*. FAO manual on the valuation and prevention of losses by pests, disease and weeds (ed. L. Chiarappa), pp. 2.1/1-2.1/1.
- Leinati, L. (1968). Contribution to the knowledge of repellents against game birds. *Proc. 22nd Congr. Italian Soc. Vet. Sci.*, Grado, Italy, 26-29 September 1968.
- Lenton, G. (1981). Qualitative and quantitative assessment of bird pests in Eastern Africa: Sudan. *Proc. 3rd Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- Lenton, G. M. (1980). Monitoring and research on *Quelea quelea ethiopica* in Sudan 1979-1980. *Min. 2nd Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- Leuthold, D. and Leuthold, B. (1972). Blutschnabelweber *Quelea quelea* als Beute von Greif- und Stelzvögeln. *Vogelwarte*, 26, 352-4.
- Linz, G. M. and Fox, G. (1983). Food habits and molt of red-winged blackbirds in relation to sunflower and corn depredation. *Proc. 9th Bird Control Semin.*, Bowling Green, Ohio, 9, 167-80.
- Lofts, B. (1962). Photoperiod and the refractory period of reproduction in an equatorial bird (*Querula querula*). *Ibis*, 104, 407-14.
- Lofts, B. (1964). Evidence of an autonomous reproductive rhythm in an equatorial bird (*Querula querula*). *Nature (Lond.)*, 201, 523-4.
- Lofts, B. and Murton, R. K. (1968). Photoperiodic and physiological adaptations regulating avian breeding cycles. *J. Zool. (Lond.)*, 155, 327-94.
- Loman, J. and Tamm, S. (1980). Do roosts serve as 'information centers' for crows and ravens? *Am. Nat.*, 115, 284-9.
- Lourens, D. C. (1957). Panathion versus Quelea. CSA Symposium on Quelea, Livingstone, 1957. CCTA/CSA Joint Secretariat, Bukavu.
- Lourens, D. C. (1960). Contribution: Union of South Africa. CCTA/CSA Quelea (60) 6. *CCTA/FAO Symp. on Quelea*, Bamako, 1960. Lagos, Nairobi and London. CCTA/CSA Publ. 58, 95-118.
- Lourens, D. C. (1961). Comments on the new race of the red-billed quelea. *Ostrich*, 32, 187.
- Lourens, D. C. (1963). The red-billed quelea. Unpubl. Ph.D. thesis, Pretoria University, South Africa.
- Luder, R. (1985a). Weeds influence red-billed quelea damage to ripening wheat in Tanzania. *J. Wildl. Manage.*, 49, 646-7.
- Luder, R. (1985b). Guidelines to estimate the first possible installation dates of red-billed quelea colonies from daily rainfall figures. Unpubl. Internal Rep., FAO/UNDP Quelea Project URT/81/013. FAO, Rome.
- Luder, R. and Elliott, C.C.H. (1984). Monitoring quelea at the national level: Tanzania. *Proc. 5th Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/81/023.
- Mabbayad, B. B. and Tipton, K. W. (1975). Tannin concentration an in vitro dry matter disappearance of seeds of bird-resistant sorghum hybrids. *Philipp. Agric.* 59, 1-6.
- MacCuaig, R. G. (1984). Terminal report of avian toxicologist. *Proc. 5th Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/81/023, pp. 19-25.
- MacCuaig, R. G. (1986). Avicide index. Monograph, Food and Agriculture Organization, Rome, Italy.
- Mackworth-Praed, C. W. and Grant, C. H. B. (1973). *Birds of west central and western Africa*. Ser. III, Vol. II. Longmans, London, UK.
- Maclean, G. L. (1957). A summary of the birds of Westminster, O.F.S. and surroundings. *Ostrich*, 28, 217-32.
- Magor, J. (1974). Quelling the quelea-bird plague of Africa. *Spectrum*, 118, 8-11.
- Magor, J. I. and Ward, P. (1972). Illustrated descriptions, distribution maps and bibliography of the species of Quelea (weaver-birds; Ploceidae). *Trop. Pest. Bull.*, 1, 1-23. Centre for Overseas Pest Research, London, UK.
- Mallamaire, A. (1959a). Control of weaverbirds in Africa. *FAO Plant Protect. Bull.*, 7, 105-12.
- Mallamaire, A. (1959b). La lutte contre le quelea en Afrique-Orientale française. *Bull. Phytoparasitaire FAO*, 7, 109-16.
- Mallamaire, A. (1961). La lutte contre les oiseaux graminivores en Afrique Occidentale (Mauritanie, Sénégal, Soudan, Niger). *J. Agric. Trop. Bot. Appl.* 8, 141-265.
- Manikowski, S. (1975). The influence of vegetation and meteorological conditions in the Lake Chad Basin on the distribution of *Quelea quelea*. Part I. Dry season. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/73/055. FAO, Rome.
- Manikowski, S. (1980). The dynamics of the Chari-Logone population of *Quelea quelea* and its control. *Proc. 4th Pan-Afr. Ornithol. Congr.*, 4, 411-21.

- Mankowski, S. (1981). Les résultats d'études sur les *Quercus queleae* dans le delta central du Niger. Unpubl. Internal Rep., FAO/UNDP Quelca Project RAF/77/047. FAO, Rome.
- Mankowski, S. (1984). Birds injurious to crops in West Africa. *Trop. Pest Manage.*, **30**, 349-87.
- Mankowski, S. (1988). Aerial spraying of quelea. *Trop. Pest Manage.*, **34**, 133-40.
- Mankowski, S. and Da Camara-Smeets, M. (1975a). Estimation de dégâts d'oiseaux sur la sorgho dans la région de N'Djamena. Unpubl. Internal Rep., FAO/UNDP Quelca Project RAF/73/055, FAO, Rome.
- Mankowski, S. and Da Camara-Smeets, M. (1975b). Observations sur les dégâts d'oiseaux dans la zone de Maroua-Lere-Pala. Unpubl. Internal Rep., I:AO/UNDP Quelca Project RAF/73/055, FAO, Rome.
- Mankowski, S. and Da Camara-Smeets, M. (1979a). Estimating bird damage to sorghum and millet in Chad. *J. Wildl. Manage.*, **43**, 540-4.
- Mankowski, S. and Da Camara-Smeets, M. (1979b). Preferences alimentaires chez *Quercus queleae queleae* (L.). *Terre Vie*, **33**, 611-22.
- Marshall, A. J. and Disney, H. J. Jr. (1956). Photostimulation of an equatorial bird (*Quercus queleae*, Linnaeus). *Nature (Lond.)*, **177**, 143-4.
- Marshall, A. J. and Disney, H. J. Jr. (1957). Experimental induction of the breeding season in a xerophilous bird. *Nature (Lond.)*, **180**, 647-9.
- Martin, L. (1976). Tests of bird damage control measures in Sudan, 1975. *Proc. 7th Bird Control Semin.*, Bowling Green, Ohio, **7**, 259-66.
- Martin, L. R. (1979). Effective use of sound to repel birds from industrial waste ponds. *Proc. 8th Bird Control Semin.*, Bowling Green, Ohio, **8**, 71-6.
- Martin, L. R. and Jackson, J. J. (1977). Field testing a bird repellent chemical on cacao crops. In *Vertebrate pest control and management Materials, ASTM STP 680* (ed. R. E. Marsh). Am. Soc. for Testing and Materials, pp. 177-85.
- Mason, J. R., Glahn, J. F., Dolbeer, R. A., and Reidinger, R. F., Jr. (1985). Field evaluation of dimethyl anthranilate as a bird repellent livestock feed additive. *J. Wildl. Manage.*, **49**, 636-42.
- Mason, J. R. and Reidinger, R. F. (1982). Observational learning of food aversion in red-winged blackbirds (*Agelaius phoeniceus*). *Auk*, **99**, 548-54.
- Mason, J. R. and Reidinger, R. F., Jr. (1981). Effects of social facilitation and observational learning on feeding behavior of the red-winged blackbird (*Agelaius phoeniceus*). *Auk*, **98**, 778-84.
- Mathew, D. N. (1976). Ecology of the weaver birds. *J. Bombay Nat. Hist. Soc.*, **73**, 249-60.
- Mayo, E. S. and Lesur, J.-C. (1985). The control of quelea and other weaverbird pests by direct treatment of wheat with the avicide fenthion. Unpubl. Internal Rep., FAO/UNDP Project URT/81/013, Tanzania.
- Mayr, E. (1971). *Populations, species, and evolution*. Belknap Press, Cambridge, Massachusetts.
- McCourtie, W. D. (1973). Traditional farming in Liberia. Unpubl. Rep., FAO/UNDP Project, College of Agriculture and Forestry, University of Liberia.
- McCullough, R. A. (1953). Supplementary whole grouse study to evaluate laboratory analysis of ruffed grouse wing and tail study. Unpubl. Internal Rep., New Hampshire Fish and Game Department, Concord, New Hampshire.
- McGrath, R. M., Kaluza, W. Z., Daiber, K. H., Van der Riet, W. B., and Glencnie, C. W. (1982). Polyphenols of sorghum grain, their changes during malting, and their inhibitory nature. *J. Agric. Food Chem.*, **30**, 450-6.
- McLachlan, G. R. (1961). Seventh ringing report. *Ostrich*, **32**, 36-47.
- McLachlan, G. R. (1962). Eighth ringing report. *Ostrich*, **33**, 29-37.
- McLachlan, G. R. (1963). Ninth ringing report. *Ostrich*, **34**, 102-9.
- McLachlan, G. R. (1964). Tenth ringing report. *Ostrich*, **35**, 101-10.
- McLachlan, G. R. (1965). Eleventh ringing report. *Ostrich*, **36**, 214-23.
- McLachlan, G. R. (1966). The first ten years of ringing in South Africa. *Ostrich / Suppl. J.*, **6**, 255-63.
- McLachlan, G. R. (1967). Twelfth ringing report. *Ostrich*, **38**, 17-26.
- McLachlan, G. R. (1969). Thirteenth ringing report. *Ostrich*, **40**, 37-50.
- McLachlan, G. R. and Liveridge, R. (1971). *Roberis birds of South Africa*. John Voelcker Bird Book Fund, South Africa.
- Mead, C. J. and Watmough, B. R. (1976). Suspended moult of Trans-Saharan migrants in Iberia. *Bird Study*, **23**, 187-96.
- Mealey, B. (1971). Blackbirds and the southern rice crop. *U.S. Fish Wildl. Serv. Resour. Publ.*, **190**.
- Mealey, B. and Royall, W. C. (1976). Nationwide estimates of blackbirds and starlings. *Proc. 7th Bird Control Semin.*, Bowling Green, Ohio, **7**, 39-40.
- Means, J. W., Jr. (1981). X-ray microanalysis of Kirtland's warbler feathers for possible population discrimination. Unpubl. M.S. thesis, Ohio State University, Columbus, Ohio.
- Meinzingen, W. (1980). Development of aerial application for the control of *Quercus queleae* in Africa. Unpubl. Internal Rep., FAO/UNDP Regional Quelca Project RAF/81/023.
- Meinzingen, W. (1983). Comparison study of droplet behaviour with an application rate of 2.1 and 4 l/ha. Unpubl. Internal Rep., FAO/DLCO-EA.
- Meinzingen, W. (1984). Effect of different application rates in quelea control in Ethiopia. 1984. *Proc. 5th Ann. Tech. Meet.*, FAO/UNDP Regional Quelca Project RAF/81/023, pp. 54-6.
- Meinzingen, W. and Latigo, A.A.R. (1986). A new technique for mass-marking of quelea (*Quercus queleae*). *Proc. 1st Quelca Tech. Meet.*, Desert Locust Control Organization for Eastern Africa, Nairobi, Kenya.
- Mierzejewski, K. (1981). The physics of aerial and groundbased spraying for quelea control. Unpubl. Internal Rep., FAO/UNDP Regional Quelca Project URT/78/022.
- Mitaru, B. N., Reichert, R. D., and Blair, R. (1983). Improvement of the nutritive value of high tannin sorghums for broiler chickens by high moisture storage (reconstitution). *Poul. Sci.*, **62**, 2065-72.
- Mitchell, R. T. (1963). The floodlight trap—a device for capturing large numbers of blackbirds and starlings at roosts. *U.S. Fish Wildl. Serv. Spec. Sci. Rep. Wildl.*, **77**.
- Moreau, R. E. (1960). *Conspicuous and classification of the ploceine weaver-birds*, Part I and Part II. *Ibis*, **102**, 298-321;443-71.
- Morel, G. (1965). La réziehung et les oiseaux dans la vallée du Sénégal. *Congr. Protect. Cultures Trop.*, Marseille, pp. 640-2.

- Morel, G. (1968). L'impact écologique de *Querqa quelea* (L.) sur les savanes sahariennes raisons du pullulerement de ce pioceide. *Terre Afr.*, 1, 69-98.
- Morel, G. and Bourlière, F. (1955). Recherches écologiques sur *Querqa quelea quelea* (L.) de la basse vallée du Sénégal. I. Données quantitatives sur le cycle annuel. *Bull. Inst. Fr. Afr. Noire Ser. A*, 17, 617-63.
- Morel, G. and Bourlière, F. (1956). Recherches écologiques sur les *Querqa quelea quelea* (L.) de la basse vallée du Sénégal. II. La reproduction. *Africana*, 24, 97-122.
- Morel, G., Morel, M.-Y., and Bourlière, F. (1957). The black-faced weaver bird or sahélienne du Ferlo septentrional, Sénégal. Etude d'une communauté aviaire. *Cah. ORSTOM Ser. Biol.*, XIII, 3-34.
- Morel, J. G. (1980). Liste commentée des oiseaux du Sénégal et de la Gambie. Suppl. No. 1. ORSTOM, Dakar.
- Morel, J. G. and Morel, M.-Y. (1982). Dates de reproduction des oiseaux de Sénégambie. *Bonn. Zool. Beitr.*, 33, 249-68.
- Morse, D. H. (1980). *Behavioral mechanism in ecology*. Harvard University Press, Cambridge, Massachusetts.
- Moseman, A. H. (1966). Pest control: its role in the United States economy and in the world. Scientific aspects of pest control. *Natl. Acad. Sci.*, 1402, 26-38. Washington, D.C.
- Mosha, A. S. and Munisi, E. N. (1983). Focus on research for rained wheat production in Tanzania. *Proc. Regional Wheat Workshop East. Cen. and Southern Africa*, Arusha, Tanzania. Nakuru Press, Kenya, pp. 20-3.
- Mott, D. F., Guarino, J. L., Schaefer, E. W., Jr., and Cunningham, D. C. (1976). Methiocarb for preventing blackbird damage to sprouting rice. *Proc. 7th Vertebr. Pest Conf.*, Monterey, California, 7, 22-5.
- Muhammed, A. and Khan, A. (1982). Perspective of edible oils research and production in Pakistan. *Pakistani Agric. Res. Council*, Islamabad, Pakistan. Unnumbered Rep.
- Munek, L., Knudsen, K. E. B., and Axtell, J. D. (1982). Industrial milling of sorghum for the 1980s. In *Sorghum in the Eighties: Proc. Int. Symp. on Sorghum* (ed. J. Merlin), ICRISAT, Patancheru, A. P., India, pp. 565-70.
- Murton, R. K. (1965). Natural and artificial population control in the woodpigeon. *Ann. Appl. Biol.*, 55, 177-92.
- Murton, R. K. and Westwood, N. J. (1977). *Avian breeding cycles*. Oxford University Press, Oxford, UK.
- Nakamura, K. and Matsuoka, S. (1983). The food-searching and foraging behaviours of rufous turtle dove, *Streptopelia orientalis* (Lathem), in soybean fields. *Proc. 9th Bird Control Seminar*, Bowling Green, Ohio, 9, 161-6.
- Naude, T. J. (1955a). The quelea problem in the Union of South Africa CCTA/CSA Africa (55)120. CSA Réunion des Spécialistes du Quélea, Dakar, 1955 Secretariat Conjoint CCTA/CSA, Bakau.
- Naude, T. J. (1955b). Quelea control South Africa. Foreign correspondence, Vol. 1, 1952-56. Unpubl. Rep., Govt. of South Africa, Pretoria.
- Ndege, J. O. (1982). Evaluation of methiocarb efficacy in reducing bird damage to ripening wheat in Arusha-Tanzania. Unpubl. M.S. Thesis, Bowling Green State University, Bowling Green, Ohio.
- Ndege, J. O. and Elliott, C.C.H. (1984). Quelea control achievements of the Tanzanian Bird Control Unit, June 1983-October 1984. *Proc. 5th Annu. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/81/023, pp. 135-57.
- Ndiaye, A. (1974). Fluctuation des populations aviaires dans la vallée du fleuve Sénégal. Unpubl. Internal Rep., FAO/UNDP Quelea Project RAF/77/055, FAO, Rome.
- Ndiaye, A. (1979). OCЛАЛАV experience in the field of bird control in West Africa. *Min. Ist. Annu. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- Neth, J. W. (1971). Identifying natal areas of Ohio-hatched Canada geese by neutron activation analyses. Unpubl. M.S. thesis, Ohio State University, Columbus, Ohio.
- Newby, J. (1980). The birds of Ouardi Rime-Ouardi Achim Faunal Reserve. A contribution to the study of the Chadian avifauna, Part II. *Malimbus* 2, 29-50.
- Newton, I. (1967). The adaptive radiation and feeding ecology of some British finches. *Ibis*, 109, 33-98.
- Newton, I. (1968). Bullfinches and fruit buds. In *The problems of birds as pests* (eds. R. K. Murton and E. N. Wright). Academic Press, London, pp. 199-209.
- Nice, M. M. (1953). The question of ten day incubation periods. *Wilson Bull.*, 65, 81-93.
- Nicolaus, L. K., Cassel, J. F., Carlson, R. B., and Gustavson, C. R. (1983). Taste aversion conditioning of crows to control predation on eggs. *Science*, 220, 212-4.
- Nikolaus, G. (1981). Wir und die Vogel. *Deutsches Buchverzeichnis* 13, 16.
- Nilsson, G. (1981). *The bird business - A study of the commercial cage bird trade*. Animal Welfare Institute, Washington, D.C.
- Nur, N. (1984). The consequences of brood size for breeding blue tits. I. Adult survival, weight change and the costs of reproduction. *J. Anim. Ecol.*, 53, 479-96.
- Orians, G. H. (1961). The ecology of blackbird (*Agelaius*) social systems. *Ecol. Monogr.*, 31, 285-312.
- ORSTOM. (1970). Monographie hydrologique de Bassin du Niger. 2ème partie La Cuvette Lacustre. Unpubl. Rep., Office de la Recherche Scientifique et Technique Outre-Mer, Paris.
- Oswalt, O. L. (1975). Estimating the biological effects of tannins in grain sorghum. *Proc. Int. Sorghum Workshop*, (ed. Publication Staff), U.S. Agency for International Development, Washington, D.C., pp. 530-54.
- Otis, D. L. (1984). A method for estimating sorghum loss to birds over large areas of Eastern Africa. Unpubl. Consultancy Rep., RAF/81/023, to FAO/UNDP, Rome, Italy.
- Otis, D. L., Holler, N. R., Lefebvre, P. W., and Mott, D. F. (1983). Estimating bird damage to sprouting rice. In *Vertebrate pest control and management materials*, ASTM STP 817 (ed. D. E. Kaukeinen). Am. Soc. for Testing and Materials, pp. 76-89.
- Otis, D. L., Knutle, C. E., and Linz, G. M. (1986). A method for estimating turnover in spring blackbird roosts. *J. Wildl. Manage.*, 50, 567-71.
- Park, P. O. (1973). Attacks by bird enemies of rice and their control. Plant protection

- for the rice crop. *Proc. Semin. Liberia*. Unpubl. Rep., FAO/UNDP, Rome, Italy.
- Park, P. O. (1974). Granivorous bird pests in Africa; towards integrated control. *Sparn*, **17**, 126–8.
- Park, P. O. (1975). The socio-economic effects of the control of grain-eating birds. Unpubl. Internal Rep., FAO/UNDP Quela Project RAF/73/055, FAO, Rome.
- Park, P. O., Adam, J., and Lubazzo, R. (1975). Trials of repellency for the protection of sorghum at Deli. Unpubl. Internal Rep., FAO/UNDP Quela Project RAF/73/055, FAO, Rome.
- Park, P. O. and Adam, J. A. (1976). Trials of repellents for the protection of rice in the car-Cameroons, 1975. Unpubl. Internal Rep., FAO/UNDP Quela Project RAF/73/055, FAO, Rome.
- Park, P. O. and Assenmou, W. (1973). Trials at Deli of chemical repellents to protect sorghum against grain-eating birds. Unpubl. Internal Rep., FAO/UNDP Quela Project RAF/73/055, FAO, Rome.
- Parker, J. D. (1986). A novel sprayer for the control of quelea birds. *Trop. Pest Manage.*, **32**, 243–5.
- Parker, J. D. and Casci, F. M. (1983). Report of a consultancy carried out with URT/81/013-FAO/UNDP Quela Bird Control Project, Arusha, Tanzania.
- Parrish, J. R., Rogers, D. T., Jr., and Prescott Ward, F. (1983). Identification of natal locales of peregrine falcons (*Falco peregrinus*) by trace-element analysis of feathers. *Auk*, **100**, 560–7.
- Pavlov, A. N. and Kolesnik, T. I. (1979). The attracting ability of caryopses as one of the factors determining level of protein accumulation in wheat grain. *Field Crop Abstracts*, **32**, 394.
- Payne, R. B. (1972). Mechanics and control of molt. In *Avian biology*, Vol. 2 (eds. D. S. Farmer and J. R. King). Academic Press, New York and London.
- Payne, R. B. (1980). Seasonal incidence of breeding, moult and local dispersal of red-billed firefinches *Lagonosticta senegala* in Zambia. *Ibis*, **122**, 43–56.
- Peña, M. (1977). Proposal for studying and establishing a control program for Madam Sarah (*Phoocococcullatus*) in Hispaniola. National Zoological Park, Santo Domingo, Dominican Republic.
- Pepper, S. R. (1973). Observations on bird damage and traditional bird pest control methods on ripening sorghum. Unpubl. Internal Rep., FAO/UNDP Quela Project RAF/73/055, FAO, Rome.
- Perrins, C. M. (1970). The timing of birds' breeding seasons. *Ibis*, **112**, 242–55.
- Perumal, R. S. and Subramanian, T. R. (1973). Studies on particle characteristics associated with bird resistance in sorghum. *Madras Agric. J.*, **60**, 256–8.
- Pienaar, V. de V. (1969). Observations on the nesting habits and predators of breeding colonies of red-billed quelea, *Quelea quelea lathami*, in the Kruger National Park. *Bokmakierie*, **21**, [Suppl.], 11–5.
- Pinowski, J. (1973). The problem of protecting crops against harmful birds in Poland. *European and Mediterranean Plant Protect. Organization OEPP/EPPO Bull.*, **3**, 107–10.
- Pinowski, J., Tomek, T., and Tomek, W. (1972). Food selection in the tree sparrow, *Passer m. montanus* (L.). Prelim. Rep. In *Productivity, population dynamics and systematics of granivorous birds* (eds. S. C. Kendaligh and J. Pinowski). Polish Scientific Publishers, Warszawa, Poland, pp. 263–73.
- Pitman, C. R. S. (1957). Further notes on aquatic predators of birds. *Bull. Br. Ornithol. Club*, **77**, 89–97, 105–10, 122–6.
- Pitman, C. R. S. (1961). More aquatic predators of birds. *Bull. Br. Ornithol. Club*, **81**, 57–62, 78–81, 105–6.
- Plowes, D. C. H. (1950). The red-billed quelea—a problem for grain-sorghum growers. *Rhod. Agric. J.*, **47**, 98–101.
- Plowes, D. C. H. (1953). Report on red-billed queleas, Oct. 1952–Feb. 1953. Unpubl. Rep., Nyamandhlovu.
- Plowes, D. C. H. (1955). Queleas in Southern Rhodesia, CCTA/CSA Africa (55) 121. CSA Réunion des Spécialistes du Quéléa, Dakar, 1955. Secretariat Conjoint CCTA/CSA, Bukavu.
- Poché, R. M., Karim, Md. A., and Haque, Md. E. (1980). Bird damage control in sprouting wheat. *Bangladesh J. Agric. Res.*, **5**, 41–6.
- Pope, G. G. and King, W. J. (1973). Spray trials against the Red-billed Quelea (*Quela quelea*) in Tanzania. Misc. Rep. 12, Centre for Overseas Pest Research, London, UK.
- Power, D. M. (1972). Geographic variation of red-winged blackbirds in central North America. *Univ. of Kansas Publ. of the Mus. Nat. Hist.*, **19**, 1–83.
- Prakash, I. (1982). Vertebrate pest problems in India. In *Proc. Conf. on The Organisation and Practice of Vertebrate Pest Control* (ed. A. C. Dubock). Imperial Chemical Industries PLC, Dramrite Printers Ltd., London, pp. 29–35.
- Price, M. L., Butler, L. G., Rogler, J. C., and Featherston, W. R. (1979). Overcoming the nutritionally harmful effects of tannin in sorghum grain by treatment with inexpensive chemicals. *J. Agric. Food Chem.*, **27**, 441–5.
- Price, M. L., Van Scoyoc, S., and Butler, L. G. (1978). A critical evaluation of the vanillin reaction as an assay for tannin in sorghum grain. *J. Agric. Food Chem.*, **26**, 1214–8.
- Prozesky, O. P. (1964). Comprehensive bird concentration at Lake Ngami. *Afr. Wildl.*, **18**, 137–42.
- Pulliam, H. R. (1973). On the advantages of flocking. *J. Theor. Biol.*, **38**, 419–22.
- Pulliam, H. R. (1975). Diet optimization with nutrient constraints. *Am. Nat.*, **109**, 765–8.
- Pyke, G. H., Pulliam, H. R., and Charnov, E. L. (1977). Optimal foraging: a selective review of theory and tests. *Q. Rev. Biol.*, **52**, 137–54.
- Quesnel, V. C. (1968). Fractionation and properties of the polymeric leucocyanidin of the seeds of *Theobroma cacao*. *Physiochemistry*, **7**, 1583–92.
- Raju, A. S. and Shivanarayana, N. (1980). Extent of damage in some early rice varieties due to bird pests at Maruturu. *Int. Rice Comm. Newslet.*, **29**, 44–5.
- Ramachandra, G., Virupaksha, T. K., and Shadaksharawamy, M. (1977). Relationship between tannin levels and in vitro protein digestibility in finger millet (*Eleusine coracana* Gaertn.). *J. Agric. Food Chem.*, **25**, 1101–4.
- Rattray, J. M. (1960). Tapis graminicis d'Afrique. Etudes Agricoles No. 49. FAO, Rome.
- Reichert, R. D., Fleming, S. E., and Schwab, D. J. (1980). Tannin deactivation and

- nutritional improvement of sorghum by anaerobic storage of H_2O , HCl , or NaOH-treated grain. *J. Agric. Food Chem.*, **28**, 824-9.
- Reichert, R. D. and Youngs, C. G. (1977a). Dehulling cereal grains and grain legumes for developing countries. I. Quantitative comparison between attrition- and abrasive-type mills. *Cereal Chem.*, **53**, 829-39.
- Reichert, R. D. and Youngs, C. G. (1977b). Dehulling cereal grains and grain legumes for developing countries. II. Chemical composition of mechanically and traditionally dehulled sorghum and millet. *Cereal Chem.*, **54**, 174-8.
- Ricklefs, R. E. (1973). Fecundity, mortality, and avian demography. In *Breeding biology of birds* (ed. D. S. Farmer). National Research Council, Washington, D.C.
- Roberts, N. (1909). *Pyramelana oryx* and its nesting parasites. *J. South Afr. Ornithol. Union*, **5**, 22-4.
- Roberts, T. J. (1974). Bird damage to farm crops in Pakistan with special reference to sunflower (*Helianthus annus*). Vertebrate Pest Control Centre, Karachi, Pakistan.
- Roberts, T. J. (ed.) (1981). *Handbook of Vertebrate Pest Control in Pakistan*. Pakistan Agric. Res. Council and Food and Agriculture Organization of the United Nations, Vertebrate Pest Control Research Centre, Karachi, Pakistan.
- Rogers, J. G., Jr. (1974). Responses of caged red-winged blackbirds to two types of repellents. *J. Wildl. Manage.*, **38**, 118-23.
- Rogers, J. G., Jr. (1978a). Repellents to protect crops from vertebrate pests: some considerations for their use and development. In *Flavor chemistry of animal foods* (ed. R. W. Bullard), ACS Symp. Ser. No. 67, American Chemical Society, Washington, DC, pp. 150-84.
- Rogers, J. G., Jr. (1978b). Some characteristics of conditioned aversion in red-winged blackbirds. *Auk*, **95**, 362-9.
- Rogers, J. G., Jr. (1980). Conditioned taste aversion: its role in bird damage control. In *Bird problems in agriculture* (eds. E. N. Wright, I. R. Inglis, and C. J. Fearne). British Crop Protection Council (BCPC) Publications, Croydon, UK, pp. 173-9.
- Rooke, I. J. (1983). Conditioned aversion by Silvereyes *Zosterops lateralis* to food treated with methiocarb. *Bird Behav.*, **4**, 86-9.
- Rooney, L. W. and Murty, D. S. (1982). Color of sorghum food products. In *Proc. Int. Symp. Sorghum Grain Quality* (eds. L. W. Rooney and D. S. Murty). ICRISAT, Patancheru, A.P., India, pp. 323-7.
- Rosa Pinto, A. A., da. (1960). O problema 'Quelea' e a agricultura em Angola. *Melhoramento*, **13**, 79-113.
- Rosa Pinto, A. A., da and Lamm, D. W. (1960). Memorias do Museu Dr Alvaro de Castro, no. 5. Lourenco Marques.
- Rowan, M. K. (1964). An analysis of the records of a South African ringing station. *Ostrich*, **35**, 160-87.
- Royama, T. (1966). A re-interpretation of courtship feeding. *Bird Study*, **13**, 116-29.
- Royama, T. (1970). Factors governing the hunting behaviour and selection of food by the great tit (*Parus major* L.). *J. Anim. Ecol.*, **39**, 619-68.
- Ruelle, P. and Bruggers, R. L. (1979). Evaluating bird protection to mechanically sown rice seed treated with methiocarb at Nianga, Senegal, West Africa. In *Vertebrate pest control and management materials, ASTM STP 680* (ed. J. R. Beck), Am. Soc. for Testing and Materials, pp. 211-6.
- Ruelle, P. and Bruggers, R. L. (1982). Traditional approaches for protecting cereal crops from birds in Africa. *Proc. 10th Vertebr. Pest Conf.*, Monterey, California, **10**, 80-6.
- Ruelle, P. and Bruggers, R. L. (1983). Senegal's trade in cage birds 1979-81. *U.S. Fish Wildl. Serv. Wildl. Leafl.*, **515**.
- Ruelle, P. J. (1983). Control of granivorous bird pests of rice using the partial crop treatment method in West Africa. *Trop. Pest Manage.*, **29**, 23-6.
- Ryan, J. (1981). Songbird stew. *Int. Wildl.*, **11**, 44-8.
- Salvan, J. (1967). Contribution à l'étude des oiseaux du Tschad. *Oiseau Rev. Fr. Ornithol.*, **37**, 255-84.
- Salvan, J. (1969). Contribution à l'étude des oiseaux du Tschad. *Oiseau Rev. Fr. Ornithol.*, **39**, 38-69.
- Schafer, E. W., Jr. (1972). The acute oral toxicity of 369 pesticidal, pharmaceutical and other chemicals to wild birds. *Toxicol. Appl. Pharmacol.*, **21**, 315-30.
- Schafer, E. W., Jr. (1979). Registered bird damage chemical controls. *Pest Control*, **47**, June:36-9.
- Schafer, E. W., Jr. (1981). Bird control chemicals—nature, modes of action, and toxicity. In *CRC handbook of pest management in agriculture* (ed. D. Pimentel) Vol. III. CRC Series in Agriculture, Boca Raton, Florida, pp. 129-39.
- Schäfer, E. W., Jr. and Brunton, R. B. (1971). Chemicals as bird repellents: two promising agents. *J. Wildl. Manage.*, **35**, 569-72.
- Schäfer, E. W., Jr., Brunton, R. B., Lockyer, N. F., and De Grazio, J. W. (1973). Comparative toxicity of seventeen pesticides to the *Quelea*, house sparrow and red-winged blackbird. *Toxicol. Appl. Pharmacol.*, **26**, 154-7.
- Schildnacher, H. (1929). Über den Wärmehaushalt kleiner Körnerfresser. *Ornithol. Monatsh.*, **37**, 102-6.
- Schnatterer, H. (1969). *Pests of crops in north-east and central Africa*. Gustav Fisher, Stuttgart, West Germany, and Portland, USA.
- Schuler, W. (1980). Factors influencing learning to avoid unpalatable prey in birds re-learning new alternative prey and similarity of appearance of alternative prey. *Z. Tierpsychol.*, **54**, 105-43.
- Seber, G. A. F. (1970). Estimating time-specific survival and reporting rates for adult birds from band returns. *Biometrika*, **57**, 313-8.
- Seber, G. A. F. (1973). *The estimation of animal abundance and related parameters*. Charles Griffin, London, UK.
- Selander, R. K. and Johnston, R. F. (1967). Evolution in the house sparrow. I. Intrapopulation variation in North America. *Condor*, **69**, 217-58.
- Sengupta, S. (1973). Significance of communal roosting in the common mynah, *Acerodathes tristis* (L.). *J. Bombay Nat. Hist. Soc.*, **70**, 204-6.
- Serrurier, A. (1965). Ecologie du *Quelea quelea quelea*. *Congr. Protect. Cultures Trop.*, Marseille, pp. 643-5.
- Serrurier, A. (1966). La lutte anti-aviaire en Afrique saharienne. *Mach. Agric. Trop.*, **13**, 28-33.
- Shannon, J. G. and Reid, D. A. (1976). Awned vs awnless isogenic winter barley grown at three environments. *Crop Sci.*, **16**, 347-9.
- Sheffé, N., Bruggers, R. L., and Schafer, E. W., Jr. (1982). Repellency and toxicity of three bird control chemicals to four species of African grain-eating birds. *J. Wildl. Manage.*, **46**, 453-7.

- Shepherd, A. D. (1981). How a typical sorghum peels. *Cereal Chem.*, **58**, 303-6.
- Shivanarayanan, N. (1980). Role of birds in agriculture. *Souvenir: Int. Meet. on Wild. Resources in Rural Development*. July 7-11, 1980, Hyderabad, India, pp. 25-30.
- Shumake, S. A., Gaddis, S. E., and Garrison, M. V. (1983). Development of a preferred bait for quelea control. In *Vertebrate pest control and management materials: 4th Symp., ASTM STP 817* (ed. D. E. Kaukeinen). Am. Soc. for Testing and Materials, pp. 118-26.
- Shumake, S. A., Gaddis, S. E., and Schafer, E. W., Jr. (1976). Behavioral response of quelea to methiocarb (Mesurol®). *Proc. 7th Bird Control Semin.*, Bowling Green, Ohio, **7**, 250-4.
- Sinclair, A.R.E. (1978). Factors affecting the food supply and breeding season of resident birds and movements of Palaearctic migrants in a tropical African savannah. *Ibis*, **120**, 480-97.
- Slater, P.J.B. (1980). Bird behaviour and scaring by sounds. *Proc. Bird Problems in Agric. Symp.* (eds. E. N. Wright, I. R. Inglis, and C. J. Feare). University of London, BCPG Publ., pp. 105-20.
- Smith, J.N.M. and Sweatman, H.P.A. (1974). Food-searching behavior of titmice in patchy environments. *Ecology*, **55**, 1216-32.
- Sonnier, J. (1957). Report on the action taken during 1956, in Senegal and Mauritania by the Department for Bird Control. *CSA Symp. Quelea, Livingstone, 1957*. CCTA/CSA Joint Secretariat, Bukavu.
- Stewart, D. R. (1959). The red-billed quelea in northern Rhodesia. *North Rhod. J.*, **4**, 55-62.
- Stickley, A. R., Otis, D. L., Bray, O. E., Heisterberg, J. F., and Grandpre, T. F. (1979a). Bird and mammal damage to mature corn in Kentucky and Tennessee. *Proc. Annu. Conf. Southeast. Assoc. Fish. Wildl. Agencies*, **32**, 228-33.
- Stickley, A. R., Jr., Otis, D. L., and Palmer, D. T. (1979b). Evaluation and results of a survey of blackbird and mammal damage to mature field corn over a large (three-state) area. In *Vertebrate pest control and management materials, ASTM STP 680* (ed. J. R. Beck). Am. Soc. for Testing and Materials, pp. 169-77.
- Stone, C. P. and Mott, D. F. (1973a). Bird damage to sprouting corn in the United States. *U.S. Fish Wildl. Serv., Spec. Sci. Rep. Wildl.*, 173.
- Stone, C. P. and Mott, D. F. (1973b). Bird damage to ripening field corn in the United States, 1971. *U.S. Fish Wildl. Serv. Wildl. Leaf.*, 505, 1-8.
- Stone, R. J. (1976). Chemical repellents can save crops. *World Crops*, May/June, pp. 132-3.
- Stresemann, E. (1965). Die Mausen der Huchhervogel. *J. Ornithol.*, **106**, 58-64.
- Stroosnijder, L. and van Hempst, H.D.J. (1982). La météorologie du sahel et du terrain d'étude. In *La productivité des paturages sahariens* (eds. F.W.T. Penning De Vries and M.A. Djicye). Centre for Agricultural Publishing and Documentation, Wageningen, pp. 37-51.
- Sultana, P., Brooks, J. E., and Brugers, R. L. (1986). Repellency and toxicity of bird control chemicals to pest birds in Bangladesh. *Trop. Pest Manage.*, **32**, 246-8.
- Taber, R. D. and Cowan, I. McT. (1969). Capturing and marking wild animals. In *Wildlife management techniques* (ed. R. H. Giles). Wildlife Society, Washington, D.C., pp. 227-318.
- Tarboton, W. (1987). Redbilled Quelea spraying in South Africa. *Gabar*, **2**, 38-9.
- Taylor, L. E. (1906). The birds of Irene, near Pretoria, Transvaal. *J. S. Afr. Ornithol. Union*, **2**, 55-83.
- Thiollay, J. M. (1975). Exemple de prédatation naturelle sur une population nicheuse de *Querlea querlea* au Mali. *Terre Vie*, **29**, 31-54.
- Thiollay, J. M. (1978a). Production et taux de mortalité dans les colonies de *Querlea querlea* (Aves: Ploceidae) en Afrique Centrale. *Trop. Ecol.*, **19**, 7-24.
- Thiollay, J. M. (1978b). Les migrations des rapaces en Afrique occidentale; adaptations écologiques aux fluctuations de production des écosystèmes. *Terre Vie*, **32**, 89-133.
- Thompson, B. W. (1965). *The climate of Africa*. Oxford University Press, London, UK.
- Thompson, J. and Jaeger M. M. (1984). Regional mass-marking and fingerprinting analysis during 1984. *Proc. 5th Annu. Tech. Meet., FAO/UNDP Regional Quielea Project RAF/81/023*.
- Thomsett, S. (1987). Raptor deaths as a result of poisoning quelea in Kenya. *Gabar*, **2**, 33-8.
- Tinbergen, J. M. and Drent, R. H. (1980). The starling as a successful forager. In *Bird problems in agriculture* (eds. E. N. Wright, I. R. Inglis, and C. J. Feare). BCPC Publications, Croydon, England, pp. 83-97.
- Taylor, M. A. (1963). *Check-list of Angolan birds*. Museu do Fundo, Lisbon.
- Trecca, B. (1976). Les oiseaux d'eau et la riziculture dans le Delta du Sénégal. *Oiseau Rev. Fr. Ornithol.*, **45**, 259-65.
- Treer, A. J. (1962). The birds of the Leopardshill area of the Zambesi escarpment. *Ostrich*, **33**, 3-23.
- UK, S. and Munks, S. (1984). Fenthion residues in quelea birds from experimental aerial spraying of Queleto at Makayuni, Tanzania, in June 1983. International Centre for the Application of Pesticides, Cranfield Institute of Technology, UK.
- UNESCO. (1959). Carte de la végétation de l'Afrique au sud du tropique du cancer. Unpubl. Rep., United Nations Educational, Scientific, and Cultural Organization (UNESCO).
- Urban, E. K. and Brown, L. H. (1971). *A checklist of the birds of Ethiopia*. Haile Selassie I University Press, Addis Ababa, Ethiopia.
- Van Ec, C. A. (1973). Cattle egrets prey on breeding queleas. *Ostrich*, **44**, 136.
- Van Someren, V.G.L. (1922). Notes on the birds of East Africa. *Novit. Zool.*, **29**, 1-246.
- Vernon, C. J. (In press). The quelea in natural ecosystems. In *The quelea problem in southern Africa* (eds. P. J. Mundy and M.J.F. Jarvis). Baobab Books, Zimbabwe.
- Vesey-FitzGerald, D. F. (1958). Notes on the breeding colonies of the red-billed quelea in S. W. Tanganyika. *Ibis*, **100**, 167-74.
- Voss, F. (1986). *ATLAS: Quelea habitats in East Africa*. Food and Agriculture Organization, Rome
- Walsberg, G. E. and King, J. R. (1980). The thermoregulatory significance of the winter roost-sites selected by robins in eastern Washington. *Wilson Bull.*, **92**, 33-9.
- Ward, P. (1965a). Feeding ecology of the black-faced dioch *Querlea quelea* in Nigeria. *Ibis*, **107**, 173-214.

- Ward, P. (1965b). The breeding biology of the black-faced dioch *Querula querula* in Nigeria. *Ibis*, **107**, 326–49.
- Ward, P. (1965c). Biological implications of quelea control in West Africa. *Congrès de la Protection des Cultures Tropicales* 601–6, Marseilles.
- Ward, P. (1965d). Seasonal changes in the sex ratio of *Querula querula* (Ploceidae). *Ibis*, **107**, 397–9.
- Ward, P. (1966). Distribution, systematics, and polymorphism of the African weaverbird (*Querula querula*). *Ibis*, **108**, 34–40.
- Ward, P. (1969). The annual cycle of the yellow-vented bulbul *Pycnonotus goiavier* in a humid equatorial environment. *J. Zool. (Lond.)*, **157**, 25–45.
- Ward, P. (1971). The migration patterns of *Querula querula* in Africa. *Ibis*, **113**, 275–97.
- Ward, P. (1972a). East Africa tropical bird-pest research project. Final Rep., Centre of Overseas Pest Research. ODA Res. Scheme R. 2092.
- Ward, P. (1972b). Synchronisation of the annual cycle within populations of *Querula querula* in East Africa. *Proc. Int. Ornithol. Congr.*, **15**, 702–3.
- Ward, P. (1973a). A new strategy for the control of damage by queleas. *PANS*, **19**, 97–106.
- Ward, P. (1973b). *Manual of techniques used in research on quelea birds*. AGP:RAL/67/087 Working Paper (Manual), United Nations Development Programme/FAO, Rome.
- Ward, P. (1978). The role of the crop among red-billed queleas *Querula querula*. *Ibis*, **120**, 333–7.
- Ward, P. (1979). Rational strategies for the control of queleas and other migrant bird pests in Africa. *Philos. Trans. R. Soc. Lond. B Biol. Sci.*, **287**, 289–300.
- Ward, P. and Jones, P. J. (1977). Pre-migratory fattening in three races of the red-billed quelea *Querula querula* (Aves: Ploceidae), an intra-tropical migrant. *J. Zool. (Lond.)*, **181**, 43–56.
- Ward, P. and Kendall, M. D. (1975). Morphological changes in the thymus of young and adult red-billed queleas *Querula querula* (Aves). *Philos. Trans. R. Soc. Lond. B Biol. Sci.*, **273**, 55–64.
- Ward, P. and Pope, G. G. (1972). Flight-tunnel experiments with red-billed queleas to determine the distribution of a solution sprayed onto birds in flight. *Pestic. Sci.*, **3**, 709–14.
- Ward, P. and Zahavi, A. (1973). The importance of certain assemblages of birds as 'information centres' for food finding. *Ibis*, **115**, 517–34.
- WARDA. (1983). Preliminary analysis of socio-economic baseline data. West Africa Rice Development Association WARDATA 83/AR-R-8A.
- Weatherhead, P. J. (1983). Two principal strategies in avian communal roosts. *Nat. Nat.*, **121**, 237–43.
- Weatherhead, P. J., Tinker, S., and Greenwood, J. J. (1982). Indirect assessment of avian damage to agriculture. *J. Appl. Ecol.*, **19**, 773–82.
- Weidner, T. (1983). Why do pesticides cost so much? *SSSI Pest Control Technol.*, July, pp. 50–2, 76.
- Wiens, J. A. and Dyer, M. I. (1975). Simulation modeling of red-winged blackbird impact on grain crops. *J. Appl. Ecol.*, **12**, 63–87.
- Wiens, J. A. and Dyer, M. I. (1977). Assessing the potential impact of granivorous birds in ecosystems. In *Granivorous birds in ecosystems* (eds. J. Piłowski and S. C. Kendeigh). Cambridge University Press, Cambridge, England, pp. 205–66.
- Wiens, J. A. and Johnston, R. F. (1977). Adaptive correlates of granivory in birds. In *Granivorous birds in ecosystems* (eds. J. Piłowski and S. C. Kendeigh). Cambridge University Press, Cambridge, England, pp. 301–340.
- Wilkinson, G. S. and English-Loeb, G. M. (1982). Predation and coloniality in cliff swallows (*Petrochelidon pyrrhonota*). *Auk*, **99**, 459–67.
- Williams, J. G. (1954). The quelea threat to Africa's grain crops. *East Afr. Agric. J.*, **19**, 133–6.
- Wilson, S. W. (1978). Food size, food type, and foraging sites of red-winged blackbirds. *Wilson Bull.*, **90**, 511–20.
- Winstanley, D., Spencer, R., and Wilkinson, K. (1974). Where have all the whitethroats gone? *Bird Study*, **21**, 1–14.
- Wolfson, A. and Winchester, D. P. (1959). Effect of photoperiod on the gonadal cycle in an equatorial bird *Querula querula*. *Nature (Lond.)*, **184**, 1658–9.
- Woronecki, P. P. and Dolbeer, R. A. (1980). The influence of insects in bird damage control. *Proc. 9th Varietib. Pest Conf.*, Fresno, California, **9**, 53–9.
- Woronecki, P. P., Dolbeer, R. A., and Stein, R. A. (1981). Response of blackbirds to Mesurol and Sevin applications on sweet corn. *J. Wildl. Manage.*, **45**, 693–701.
- Woronecki, P. P., Stein, R. A., and Dolbeer, R. A. (1980). Compensatory response of maturing corn kernels following simulated damage by birds. *J. Appl. Ecol.*, **17**, 737–46.
- Worthing, C. R. (Ed.) (1979). *The pesticide manual—a world compendium*, 6th edn. British Crop Protection Council, UK.
- Wright, E. N. (1981). Chemical repellents—a review. In *Bird problems in agriculture*. *Proc. Conf. Understanding agricultural bird problems* (eds. E. N. Wright, I. R. Inglis and C. J. Heurel). Royal Holloway College, University of London, April 4–5, 1979, pp. 164–72.
- Yahia, G. (1957). A note on the occurrence and control of the Red-billed Weaver (*Querula querula aethiopica*) in the Sudan. *CSA Symp. Querula*, Livingstone, 1957. CCTA/CSA Joint Secretariat, Bukavu.
- Yates, F. and Zacompanay, B. A. (1955). The estimation of the efficacy of sampling, with special reference to sampling for yield in cereal experiments. *J. Agric. Sci.*, **25**, 545–77.
- Yom-Tov, Y., Imber, A., and Osterman, J. (1977). The microclimate of winter roosts of the starling *Sturnus vulgaris*. *Ibis*, **119**, 366–8.
- York, J. O., Howe, D. F., Bullard, R. W., Nelson, T. S., and Stallecup, O. T. (1981). The purple testa in sorghum, *Sorghum bicolor* (L.) Moench. *Proc. 12th Biennial Grain Sorghum Research Utilization Conf.* (ed. D. E. Weibel). Grain Sorghum Producers Association and Texas Grain Sorghum Producers Board, Lubbock, Texas, p. 113.
- York, J. O., Bullard, R. W., Nelson, T. S., and Stallecup, O. T. (1983). Dry matter digestibility in purple testa sorghums. *Proc. 37th Ann. Corn Sorghum Research Conf.*, Chicago, Illinois (eds. H. T. Loden and D. Wilkinson). American Seed Trade Association, Washington, D.C., pp. 1–9.

- Zahavi, A. (1971). The function of pre-roost gatherings and communal roosts. *Ibis*, 113, 106–9.
- Zaske, J. (1973). Tropfengroessenanalyse unter besonderer Berücksichtigung der Zersetzung im chemischen Pflanzenschutz. Dissert. Tech. Univ. Berlin.
- Zeinabdin, M. H. (1980). The potential of vegetable tannin as a bird repellent. Unpubl. M.A. thesis, Bowling Green State University, Bowling Green, Ohio.
- Zeinabdin, M. H., Bullard, R. W., and Jackson, W. B. (1983). Mode of repellent activity of condensed tannin to quail. *Proc. 9th Bird Control Seminar*, Bowling Green, Ohio, 9, 241–6.