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Mass-marking quelea with fluorescent pigment particles

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Introduction

An understanding of the annual or seasonal migration or daily feeding flights of quelea in relation to local and regional agricultural patterns is necessary for developing selective control strategies. In the 1950s in eastern Africa, ringing was initiated under the premise that 'when large numbers of birds have been ringed throughout East Africa, it will be easier to untangle some of the outstanding questions regarding the extremely complex migratory problems' (Haylock 1957). Ringing and recovery efforts in Tanzania (Disney 1960), South Africa (Chapter 11; Jones 1980; Ward 1971), and Ethiopia (Chapter 10) have provided examples of local and migratory movements and contributed to the overall migration theory of the species (Morel and Bourlière 1955; Ward 1971). However, this marking technique is extremely laborious during both ringing and recovery phases, and recoveries have been proportionally very few. The limitations of ringing and the desire for more precise knowledge of movements resulted in efforts to develop other identification or marking techniques. Populations have been intensively sampled for 'fingerprint' patterns (Chapter 4). Trace element profiles (Chapter 7) and radio-telemetry (Chapter 6) have been investigated or implemented as techniques to differentiate populations or follow local movements, respectively. As a result, movement patterns appear to be much more complex than Ward (1971) previously thought.

Another identification technique that has proven very useful has been the aerial or terrestrial application of fluorescent pigment particles to birds in nesting or roosting aggregations. This technique is compatible with the other marking methods, yet it permits marking literally hundreds of thousands of birds during one evening at relatively low cost using standard control

equipment and procedures. It also offers the possibility of obtaining a reasonable number of marked recaptures, depending on the specific situation. Birds can be collected in mist-nets or after control operations and examined under ultraviolet (UV) light for the presence of fluorescent particles. This chapter describes the historical development, current methodology, and future direction and use of this unique capability.

Techniques development

Background

The development of the fluorescent mass-marking technique for quelea began when Bruggers and Bortoli (1979) conducted laboratory marking trials with various fluorescent dyes and paints in Senegal. At the same time, researchers at DWRC were studying ways to mass-mark Red-winged Blackbirds *Agelaius phoeniceus* with various particle markers. The combined efforts of personnel involved in these two initial approaches resulted in the development of mass-marking methodology for quelea. Mass-marking was first used in 1981 in Ethiopia to determine quelea movements in the Ethiopian Rift Valley (Jaeger *et al.* 1986). It was subsequently used in Kenya (Thompson and Jaeger 1984), in Tanzania (Luder and Elliott 1984), and in Niger in 1987 (R. Bruggers and J. Bourassa, unpubl. data) to delineate movement patterns relative to susceptible cereal crops. It was also used in the United States to study dispersal patterns from roosts of migrating Red-winged Blackbirds (Knittle *et al.* 1987).

Markers and formulation

In early attempts to mark wildlife, fluorescent dyes were dissolved in a liquid medium and sprayed on the animal (Evans and Griffith 1973; Taber and Cowan 1969). The dyes were translucent and fluoresced under UV light. For birds, these dyes presented problems when sprayed in small quantities because the liquid spread on the feathers, and even though it fluoresced, it was often quenched on darker plumage. In contrast, the new quelea marking technique described in this chapter uses particles that fluoresce when exposed to long-wave (360 nm) UV light. The highly fluorescent particles are not diluted or quenched on a feather; small flecks of markers, as minute as 10 µm in diameter (slightly larger than a red blood cell) can be detected on feathers in UV light with the unaided eye.

The markers are amorphous, transparent organic resin particles that contain dyes which are capable of fluorescing while in a solid state solution. DAY-GLO Color Corporation is the manufacturer of the markers we have

used. They produce a variety of fluorescent particles for incorporation into various solvents and product bases to make paints, inks, plastics, or other products that require a fluorescent pigment. Most particles are 3.5–4.0 µm in size, but they range from <1.0 µm to 50.0 µm; 95 per cent of the particles fall between 2 and 13 µm. Ten colours are available, but depending on observer discrimination ability, only four to six colours or combinations of two colours work well. The A and AX series of particles have proven satisfactory for formulating avian mass-markers. The specific gravity of particles in these series is 1.36, which causes them to sink in the marker formulation but stay suspended when slightly agitated. The particles are essentially non-toxic; the oral LD₅₀ in rats is > 16 g/kg.

The marker spray formulation was developed to be compatible with current avicide application equipment and techniques used in Africa (Plate 5a). The components of the formulation are, by volume, 95 parts diesel fuel and 5 parts boiled linseed oil plus, by weight, 2 parts particle marker. Thus, a 100-l spray load would contain 95 l diesel fuel, 5 l boiled linseed oil, and 2 kg particle marker. The boiled linseed oil is the adhesive: it polymerizes to a hard, somewhat flexible film that holds the marker in place after the diesel fuel evaporates. Raw linseed oil is unacceptable because it does not harden but instead remains as a liquid on the feathers. The boiled linseed oil is first mixed with the diesel fuel, then the marker particles are mixed homogeneously into the liquid. The markers will slowly settle to the bottom if the mixture is not regularly agitated, and therefore the marker formulation should not be mixed and stored for later use. Storage of the formulated marker will also result in particle degradation. Initial examination of marker wear rates on quelea (Bruggers and Bortoli 1979) indicated that the wings held markers better than other body parts (Plate 5b). Additional examination of wear rates in Red-winged Blackbirds (Knittle *et al.* 1987) determined that wing collection was the most efficient means of detecting marked birds. Wing collection has been used for quelea mass-marking studies.

Fluorescent particles can be mixed into a toxicant spray formulation to determine the location of toxicant droplets. If the marker is used for this purpose, it is necessary to determine compatibility between marker and toxicant formulation. Some toxicant chemicals will degrade or destroy the marker on contact. Marker particles in the GT series are more resistant to a wider range of toxicant chemicals.

Application equipment and methods

A variety of aircraft, spray systems, and ground-spraying equipment have been used to mark quelea. Both fixed-wing (De Havilland Beaver) and rotor-wing (Bell Jet Ranger 206) aircraft have been successfully used to mass-mark

quelea roosts and nesting colonies (Plate 5a). They have been fitted with spray systems like Micronair® (AU 3000, AU 4000), or similar rotating-disc designs with two sprayers per aircraft, or a boom and nozzle system. Droplets with a volume median diameter (vmd) of 100 µm seem to mark birds well, but marking should still be successful with droplets in the range of 40–150 µm vmd. Droplets outside this range could be too fine to leave marks or too large to have a chance of impacting on a bird, either because they are too few or they do not remain airborne long enough. As a general rule, a boom- and nozzle-type spray system will require a greater volume of spray liquid than a rotating-disc spray system to mark the same number of birds. The boom and nozzle system produces a wide range of droplet sizes at a given setting, and thus is less effective in producing the desired droplet sizes. The suggested time and methods used in aerial spray control operations should be followed to mark the maximum numbers of quelea (Chapter 21).

The concept of mass-marking using ground application techniques is basically the same as for aerial application—bringing a cloud of droplets into contact with birds. During aerial spraying, spray both drops and drifts, while during ground spraying, spray movement relies mainly on wind drift with a slight amount of vertical movement. This difference in application requires that the ground-generated spray clouds have droplet diameters sufficiently small to hang in the air, as the wind drifts the spray cloud into the birds or the birds fly through it. Droplets in the 40- to 60-µm range can be transported in light winds (2–5 m/s) and will mark birds well; droplets <40 µm are carried in the slightest breeze (<2 m/s), while droplets >60 µm will drop to the ground quickly unless the wind speed exceeds 5 m/s. Therefore, a spray cloud of droplets from ground sprayers with a vmd of 40 µm should provide acceptable marking under a variety of wind conditions.

In some situations, ground sprayers can offer a less expensive way to mark quelea than aircraft. Ground sprayers have been successfully used to mark quelea in field tests in Niger (R. Bruggers and J. Bourassa, unpubl. data) and in Kenya (Meinzingen and Latigo 1986). Both are transported to the marking site by vehicle. The ground sprayer used in Niger was a rotating disc unit that was mounted on a telescoping pole and driven by an air compressor powered by a generator. This unit is set in a fixed location upwind of the marking site (GTZ 1986). More than one unit may be required to obtain proper marking coverage of a site considering the size of the roost or colony and the wind conditions. The ground sprayer used in Kenya was a Micro-nair® AU 7000 rotating-disc type that can be attached to vehicles or mounted on a wand that is hand-held and powered by electricity from a portable generator. The process of matching droplet size, wind speed and direction, distance from marking site, sprayer height, spray volume and duration with the 'window' of best spraying time to mark birds requires the same skill and experience as that needed to aerially mark quelea. Any sprayer design that

functions well for the purpose of controlling quelea should be adaptable to the delivery of the marker formulation.

It is very important to keep accurate records of all parameters during marker applications as this will help improve the success of future marking sprays. Table 5.1 illustrates the type of information that should be collected and typical spray parameters that should be determined and recorded for each marking operation.

Table 5.1. Example of aerial quelea mass-marking record sheet.

<i>Spray site</i>	
Concentration	Colony
Size (ha)	10
Mean no. active nests/ha	2380 ± 428 (± 1 SD)
Total no. active nests	23 800
% nests occupied	91
Installation date	21, 22 Mar.
Composition on spray night	24- to 28-day-old young and a few roosting adults
Total no. birds	
Nesting adults, nestlings, fledglings	50 000
Roosting adults and juveniles	5000
<i>Spray parameters</i>	
Date	25 Apr.
Time	1820-1830 h
Vol (l) marker formulation	60
No. passes above colony	4
Ambient temperature (°C)	24
Wind speed at 2-m height (km/h)	8
Flight height (m) above tallest canopy	15-20
Flight speed (km/h)	165
Flow rate (l/min per Micronair AU 4000 atomizer)	21.5
Droplet size (μm, vmd)	80
<i>Estimated no. birds marked</i>	
% adults	85
% nestlings, juveniles, fledglings	95

Mass-marking studies

Since the onset of mass-marking operations in Africa, several million birds have been marked using fixed-wing aircraft, helicopters, and ground sprayers. When marking has taken place in the context of a well-defined movement study and has been followed by conscientious and thorough post-spray bird collections, marked birds usually have been found and interesting and useful information has resulted.

Mass-marking efforts in Ethiopia (1981), Kenya (Dec. 1982/Jan. 1983, 1984 and 1985), and Niger (1987) have resulted in an estimated total of 6 million birds marked and 352 marked birds recovered of 12 760 sampled (Table 5.2). These studies documented the movements of birds from distant breeding grounds to agricultural areas and confirmed itinerant breeding in Ethiopia (Jaeger *et al.* 1986), provided a basis for recommending control strategies in Kenya (Jaeger 1984), and confirmed the impact of quelea on rice in Niger (R. Bruggers, unpubl. data). In general, mass-marking appears to be particularly valuable in circumstances exemplified by these situations (Table 5.2), when it is of interest to know when and where quelea aggregations are likely to threaten cereal crops. Besides permitting one to obtain information on breeding biology and bird movements, this information is necessary for making quelea control more selective and focusing it where it can be of greatest benefit (Thompson and Jaeger 1984).

Discussion

The success of the first field study in Ethiopia seemed to result in optimistically high expectations as to the utility of this technique in unravelling the movements of quelea. In some marking situations, birds were sprayed, collected in spray sites to determine marking effectiveness, and then little or no effort was made to collect them again. In other situations, birds were sprayed and collected in widespread localities without first having determined the effectiveness of the marking spray. In still other situations, large numbers of birds were sprayed, immediately collected to determine effectiveness, and conscientiously collected later without finding marked birds.

A number of factors seem to be responsible for variability in the results and the recovery rates of marked birds. These include (1) failure to estimate the number of birds marked, (2) deterioration of marks, (3) moult, (4) grouped dispersal of birds from particular spray sites, and (5) time and personnel available to collect and examine wings, a factor that greatly influences post-spray sampling strategies and, ultimately, sample size. The real dilemma, however, is interpreting negative data obtained from a properly designed and conducted study.

Table 5.2. Description of mass-marking operations of quelea in Africa between 1981–1987 from which marked birds were later recovered.

Country	Aggrega-tion	Location	Data	Marker ^a	Birds marked		Number of birds sampled	marked location	Comments	Source
					Aerial application	No.				
Ethiopia	South-west Colony A	June 81	FO	Aerial	655 000	64	200	6	Gewane I	93 days; 650 km; in colony
	Colony B	June 81	FO	Aerial	122 000	51	50	1	Gewane II	93 days; 700 km; in colony
	Colony C	June 81	FO	Aerial	463 000	44	39	2	Melka Sede roost	67 days; 650 km; in roost
							1000	1	Issu Plain	86 days; 650 km; in colony
							480	3	Lake Zawai	100 days; 500 km; in colony
Kenya	Mwea Roost	Apr. 84	FO	Aerial	1.2 × 10 ⁶	82	940	29	Nanyuki roost	73 days; 95 km; in roost
							290	7	Timau	128 days; 95 km; in roost
Tsavo East	Colony A	Jan. 85	FO	Aerial	39	2468, Tsavo	5	—	Thompson and Jaeger 1984	58 days; immediate area; in breeding colony
	Colony B	Mar. 85	SY	Aerial	Several	13–19 6075, Tamz.	—	—	Thompson and Jaeger 1984	27 days; immediate area; in breeding colony
	Colony C	Mar. 85	FO	Aerial	million	17	—	—	Thompson and Jaeger 1984	69 days; 500 km; in breeding colony
	Colony D	Mar. 85	FO and SY	Aerial	11	8542, Total	1,1	Tsavo; Dacoma	Thompson and Jaeger 1984	99 days; immediate area; in breeding colony
Niger	Tillaberry Roost A ^b	Apr. 87	FO	Ground	400 000	64	1168	254	Local roosts and crop areas	20 days; 1–50 km; in roosts and crops
	Roost B	Apr. 87	SY	Ground	91 500	61	—	—	Bruggers et al., unpubl. data	17 days; 1–50 km; in roosts and crops
									Bruggers et al., unpubl. data	

^aDay-Glo fluorescent particles were used individually [Fire Orange (FO) and Saturn Yellow (SY)] or mixed (FO, 75%; SY, 25%). Formulation ratios for 50 l consisted of 47.5 l diesel fuel, 2.5 l boiled linseed oil, and 1 kg marker.

^bRoosts were comprised of Golden Sparrows *Passer luteus* and Indian.

Estimates of marked birds

The effectiveness of the marker spray must be determined at the spray site by collecting birds and estimating the number marked. Interpreting data from future collections of birds is based entirely on some idea as to the percentage of birds originally marked and the quality of the marks relative to detectability and longevity. These initial post-spray samples are particularly important if no marked birds are found in future collections.

Deterioration of marks

Marked birds may not be found if the marks have not initially adhered or if they have worn off by the time samples of birds are collected. Mark retention has not systematically been documented in the field, primarily because one can never assume a stable, local population of birds from which to sample over time. Population turnover further complicates any retention studies. Although R. Allan (personal observation) found it difficult to remove marks on primaries by simulated abrasion with a brush, and B. Johns (unpubl. data) demonstrated good marker wear on quelea wings subjected to weathering compounds in a paint weathering instrument, one must assume that markers are lost with the wear of primary feathers. Under laboratory conditions, caged quelea lose markers progressively over a period of several months (B. Johns, unpubl. data). In field studies, marked wings have been found up to 100 days post-spray when moult was not a complicating factor (Jaeger *et al.* 1986).

Moult

Post-breeding moult is an important concern when marking adults in breeding colonies. Unless post-breeding moult is arrested, adults usually complete it (which includes remiges and rectrices) about 4 months from its onset. If juveniles were present at the time a colony was sprayed, marks should be present on their feathers for considerably longer as they do not start their moult for 9–13 weeks after hatching. Likewise, marks could be on the feathers of adults which had begun moult and had fresh new feathers at the time of spraying (Luder and Elliott 1984). None the less, moult greatly reduces the chances of finding marked birds over time.

Group cohesion

Group cohesion appears to be another potentially important characteristic of quelea movements that affects marker recovery. Results from mass-

marking suggest that quelea tend to remain together as a group during movements: group cohesion was evident in the Ethiopian study (Jaeger *et al.* 1986). Similarly, quelea marked at Mwea, Kenya, were recovered only at Timau, Kenya (Thompson and Jaeger 1984). Group cohesion may offer an explanation for not recovering marked quelea from suspected sites. Marked birds could be expected to be found if they disperse widely and are adequately sampled. However, a marked group of 100 000 quelea that migrate together can easily be missed in much of this species' inaccessible range without extremely widespread sampling.

Logistical constraints and sample sizes

In studies where marked birds were found after at least 1 month and away from the spray site, samples of at least 400–500 birds were needed to have a good opportunity to recover marked birds (Thompson and Jaeger 1984). Small collections of 10–100 birds can yield recoveries in restricted areas where birds have localized and apparently repeated movements such as the Tillaberry region of Niger on the Niger River (R. Bruggers, pers. obs.), where 294 marked birds were recovered from a sample of 1168. However, obtaining large post-spray samples of quelea can be very time-consuming and tedious, unless they can be collected following lethal spray operations. Similarly, considerable time can be spent looking at wings for paint particles under UV light. C. Elliott (Luder and Elliott 1984) estimated that he spent 37 h over a period of several days checking 3716 wings following a spray in Tanzania.

The importance of thorough sampling cannot be overstressed as deductions about movements are also made on the basis of negative collections. Elliott (1983b) described the difficulty of interpreting negative data from colonies in Tanzania following a marking spray in Tsavo East, Kenya, in 1983. Negative results can fit so many hypotheses that using them to try to improve control strategies is confusing.

In contrast to the confusion that can exist in trying to interpret data from an inadequate post-spray sampling design is the clarity of information that can be generated from proper sampling. Knittle *et al.* (1987) wished to determine the spring dispersion of Red-winged Blackbirds in North America from spring roosts in the central United States. They estimated that they marked 10.6 million birds in roosts in 4 h. A post-spray collection network by investigators and co-operators was established in 19 states and 3 Canadian provinces in 1982 and 11 states and 3 provinces in 1983. They collected 8880 birds during 2- to 10-week sampling periods and found 687 were marked. Marked birds were found over an area of 1.8 million square kilometres. The general movement pattern of these blackbirds was according to predicted hypotheses. However, movements of a considerable number of other birds

were unexpected. Prior to this work, the seasonal distribution of blackbirds had been determined on the basis of banding data, which, as we have mentioned, is a particularly laborious task. To recover sufficient numbers of birds over an appropriately large area to obtain a meaningful analysis had taken many years. This mass-marking study further demonstrates how ideal and efficient the technique can be for understanding complex distribution patterns.

The sampling thoroughness and overall success of these kinds of studies stimulate the desire for implementing more sophisticated studies and interpretations. Concerns relating to (a) the number of birds that must be sampled from a location remote from the spray site to ensure sufficient sampling to detect marked birds, and (b) proper sampling to determine the proportion of marked birds that migrate in different directions need to be addressed. However, accurate estimates of pre-spray colony or roost populations, the percentage of birds marked, and thorough post-spray sampling are needed. One must also make assumptions (1) of the percentage of marked birds that can be expected to migrate to a particular area, (2) that no loss of markers occurs during the study, (3) that markers are properly identified, (4) that birds collected on each occasion are a representative sample of the roost population each time, (5) that birds experience fates independent of each other, and (6) that mortality is negligible (Otis *et al.* 1986).

Technique improvements

Future use of the mass-marking technique could benefit from technical improvements in marking methodology. The marker particle size and the large quantity used during marker operations cause considerable concern about contamination and, ultimately, data interpretation. Care must particularly be taken to prevent colour contamination when two or more colours of particles are used in an operation. Wings collected for examination must be handled and examined in a way that prevents false positive marks from occurring. Any procedural innovations that reduce contamination will improve the technique: mixing procedures for the marker formulation and dedicated use of equipment and vehicles are possible areas of improvement.

The number of colour codes that can currently be differentiated on feathers is limited to between four and six, depending upon the use pattern. Improvements in the number of marker codes will be required if several groups or organizations wish to mark quelea several times at different sites. DWRC is developing a method to incorporate a new rare-earth elemental code in addition to the colour pigment in the mass-marking spray formulation. In this marking system, the fluorescent colour of the markers would indicate a marked bird and the new rare-earth code would identify the particular spray application. This marking system would provide an almost

unlimited number of codes, but it would require a sophisticated electronic detection instrument to distinguish each of them. Also, improvements in the adhesive formulation and a better understanding of how the marks wear off the feathers are required to extend the marker retention for the lifetime of the feathers between moults. Finally, detecting markers on wings is very labour intensive. The screening process could be improved by using a detection device that would sense the presence of particular wavelengths of light emitted from the marker under UV light.

Conclusions

It has been clear to everyone involved in mass-marking activities that the technique has immense potential for understanding quelea ecology and for providing information upon which to develop efficient, selective control operations. The technique is particularly helpful when used in conjunction with 'fingerprint' profiles, to offer a much more valuable means of determining quelea movement patterns than either technique offers by itself. Information and conclusions arising from the marking studies in Ethiopia in 1981 and in Kenya in 1984 and 1985 were enhanced by the simultaneous development of 'fingerprint' profiles for birds collected at all locations. These profiles are particularly important when only a single marked bird is found in the sample. Obviously, interpretation of 'fingerprint' data is only as reliable as the ornithologists' expertise. However, finding fluorescent-marked birds in these samples provides indisputable proof for local and regional movements. As previously mentioned, the work must be conducted within the framework of a well-defined hypothesis and have adequate logistical support to determine the destination of marked birds.

References

- Abilarin, 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 *Nannus arquata*. *Ibis*, 121, 213-6.
- Adesiyan, A. A. (1973). Bird damage to cereals grown in the dry season in some parts of northern Nigeria. *Sanaru Agric. Newslett.*, 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.
- Ali, 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 granivores 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. *Path. 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 Miskell, J. E. (1983). Birds of Somalia their habitat status and distribution. *Scopus Special Suppl.*, No. 1.
- Ashton, H. (1957). Sixth ringing report. *Ostrich*, 28, 98-115.
- Asquith, T. N., Isono, 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.
- Barri, M. H. (1983). Quelea movement patterns in Somalia (April 1982- April 1983). *Proc. 4th Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/81/023, pp. 40-4.
- Barri, N. (1973). Incidence de la suppression d'un des parents sur le devenir de la couvée chez *Quelea quelea* (L.). Efficacité 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. Techn. Newslet.*, **5**, 9-12.
- Bauer, 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., Jolani, M. G., Misra, S. S., and Chander, D. (1969). Studies on relative bird damage to different experimental hybrids of bajira. *Indian J. Entomol.*, **30**, 69-71.
- Bertam, B. C. (1978). Living in groups: predators and prey. In *Behavioral 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. Newsfl.*, **22**, 9-14.
- Besser, J. (1978). Improvements in the use of 4-aminopyridine for protecting agricultural crops from birds. *Proc. 8th Verkehr. 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.
- Blen, A. R., Ames, R. B., Liew, C. S., and Pryzbylek, J. M. (1983). Effect of preharvest application of Dimethipin on grain moisture, milling quality and yield of rice. *Proc. 10th Ann. Meet. Plant Growth Regul. Soc. America*, p. 241-7.
- Blessin, C. W., Anderson, R. A., Deatherage, 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.
- Boquet, 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 sorgho de decrue 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.
- Boudeau, 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. Natur. Wildl. Fd.*, **3**, 194-6.
- Bray, O. E., Larsen, K. H., and Mott, D. I. (1975). Winter movements and activities of radio-equipped starlings. *J. Wildl. Manage.*, **39**, 795-801.
- Breman, H., Cisse, A. M., Djiteye, M. A., and Elbersen, 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., Matice, J., Miskell, 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. *Traffic Bull.* IV, 12-22. Wildlife Trade Monitoring Unit, IUCN Conservation Monitoring Centre, Cambridge, UK.
- Bruggers, R. L., Bolh, 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. Schaefer, 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 masques (*Ploceus 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 pest and crop protection strategies for cereals of the semi-arid African tropics. In *Sorghum in the Eighties: Proc. Int. Symp. on Sorghum* (ed. J. Martin). ICRISAT, Patancheru, A. P., India, pp. 303-12.
- Bruggers, R. L., Jaeger, M. M., and Bourassa, J. B. (1983). The application of radiotelemetry for locating and controlling concentrations of red-billed quelea in Africa. *Trop. Pest Manage.*, 29, 27-32.
- Bruggers, R. L., Jaeger, M. M., Keith, J. O., Hegdal, P. L., 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., Murslid, 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., Shivanarayanan, N., Santhaiah, N., and Okuno, I. (1984b). Preliminary investigations of the effectiveness of trinethacarb 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. *Afrika*, 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., Schaefer, 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. Kaukenen). Am. Soc. for Testing and Materials, pp. 66-75.
- Bullard, R. W. and Shunake, 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 progress 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., Zemelabdin, 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 Grossmaire, P. (1958). Enquête auprès des populations du fleuve Sénegal 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 Motu, 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.

- Capreita, 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. *Ecology*, **60**, 611-7.
- Caraco, T., Martindale, S., and Puliham, H. R. (1980). Avian flocking in the presence of a predator. *Nature*, **285**, 400-1.
- Caughley, G. (1977). *Analysis of vertebrate populations*. Wiley, Chichester.
- Cheke, 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 Agric. Food Chem.*, **26**, 679-83.
- 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. Chiatarpa), pp. 2.21-2.28.
- Cisse, A. M. and Breman, H. (1982). La phytocologie de Sahel et du terrain d'étude. In *La productivité des peintures 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 (mange-mil) 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 *lathami*-group of *Quelea quelea* (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. *Kalectr.*, **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*, **1003**, 10-2.
- Crook, J. H. (1960). Studies on the social behaviour of *Querula quaelea* (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. J.*, **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 Wilcoxen, 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 granivores 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 quelea* 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*. Assitaabarov 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 ploceina*): 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 Peterik, T. J. (1968). Possible differentiation of natal areas of North American waterfowl by neutron activation analysis. *J. Wildl. Manage.*, **32**, 274–9.
- Dhindosa, 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 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 quetula in Tanganyika. CCTA/CSA Quetula (60)9. CCTA/FAO Symposia on *Querquedula*. Bamako, CCTA/CSA Publ. **58**, 143–9.
- Disney, H. J. de S. (1964). Quetula 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. acutirostris*) 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 rhythmic in a xerophilous equatorial bird *Querquedula querquedula*. *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 querquedula* 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 querquedula* (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 the Eighties: Proc. Int. Symp. on Sorghum* (ed. J. Merlin), ICRISAT, Patancheru, A. P., India, pp. 313–16.
- Doggett, H., Curtis, D. L., Laubscher, F. X., and Webster, O. J. (1970). 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. *Project 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.
- Dotorow, E. (1973). Grunddaten und Überlegungen zum Einsatz einer wirkungsvollen Sprachausstreuung für die Altvogelbekämpfung im Nistplatz. 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. Naturbewerbe.
- Dunbar, R. J. M. and Crook, J. H. (1975). Aggression and dominance in the weaver bird, *Querquedula querquedula*. *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. Kendal). 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-152e. 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.
- Eggoord, J. H., Fry, C. H., and Dowsett, R. J. (1973). African migrants in Nigeria. *His. 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, pp. 35–42.
- Elliott, C.C.H. (1981b). Methods for assessing the efficiency of aerial spraying control operations on quelea colonies and roots. In *Vertebrate pest control and management materials*. ASTM STP 752 (eds. E. W. Schaefer, 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, pp. 35–42.
- Elliott, C.C.H. (1981d). Monitoring of *Querquedula querquedula* 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.
- 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. *Project Ecol.*, **1**, 159–69.
- Elliott, C.C.H. (1983a). The quelea bird as a pest of wheat in eastern and southern

- Africa. *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/78/023*.
- 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 Beesley, 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**, 1-117.
- 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 Mankowski, 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.
- Elmahdi, 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.
- Elmahdi, E. M., Bullard, R. W., and Jackson, W. B. (1985). Calcium carbonate enhancement of methiocarb repellency for quelea. *Trop. Pest Manage.*, **31**, 67-72.
- Emlen, 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 Bruggers, 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 Semin.*, 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 scout'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. Protect.*, **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.
- Feece, C. (1984). *The starling*. Oxford University Press, Oxford and New York.
- Feece, 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 Semin.*, 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 camarooptera in Uganda (Aves: Sylviidae). *J. Zool. (Lond.)*, **189**, 233-58.

- Frontan, B. and Person, S. (1974). *An illustrated guide to the grasses of Ethiopia*. Chilao Agricultural Development Unit, Asella, Ethiopia.
- Fumillayo, 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. *Lemnularia* spp. *Philipp. Agric.*, **65**, 363-6.
- Gaston, A. (1973). Esquisse de reconnaissance des groupements végétaux de la zone de recherches écologiques intensives du projet *Quielea quelea* (Région de N'Djamena). Unpubl. Internal Rep., FAO/UNDP Quielea Project RAF/67/087, FAO, Rome.
- Gaston, A. and Lambarque, G. (1976). Travaux phytocologiques en relation avec la lutte contre *Quielea quelea* - Bilan de quatre années. Rapport final, FAO/UNDP Regional Quielea 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 *Quielea quelea aethiopica* in the Republic of the Sudan during 1964/65/66/67. 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. 32nd 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.
- Gillet, 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 Melville, D. S. (1983). *Molt in birds*. British Trust for Ornithology, Guide No. 19.
- Goldstein, J. L. and Swain, T. (1963). Changes in tannins in ripening fruit. *Phytochemistry*, **2**, 371-83.
- Goss-Custard, J. D. (1977). Optimal foraging and the size selection of worms by redshank, *Tringa totanus*, in the field. *Journ. 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 Quielea Project RAF/73/055, FAO, Rome.
- Grant, C. L. (1953). Spectrographic analysis of ashes of feathers and bones of ruffed grouse. Unpubl. Internal Rep., New Hampshire Fish and Game Department, Concord, New Hampshire.
- Gras, G., Hasselman, C., Pelissier, 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 *Quielea* 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 Reunion des Spécialistes du Quielea, Dakar, 1955. Bukavu, Secretariat Conjoint CCTA/CSA.
- Grue, C. E., Fleining, W. J., Busby, D. G., and Hill, E. F. (1983). Assessing hazards of organophosphate pesticides to wildlife. *Proc. North Am. Wildl. Conf.*, **48**, 201.
- Grue, 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 [*Quielea quelea* (L.)] in Nordostnigeria. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, West Germany.
- GTZ. (1986). Rotations-Driftsprachanlage. 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 (*Quielea 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, I. (1980). Vegetable tannins--Structure and biosynthesis. 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-145e, 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 (*Quielea quelea*) in the southern and central Rift Valleys during 1983 and 1984 control seasons. *Proc. 5th Annu. Tech. Meet.*, FAO/UNDP Regional Quielea 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., Bohl, W., Besser, J., De Graizo, J., and Bruggers, R. L. (1982). Evaluating the bird repellency of methiocarb. *Malinibus*, **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. Blanck). Reinhold, New York, N.Y., pp. 411-52.
- Harris, H. B. (1969). Bird resistance in grain sorghum. *Proc. 24th Annu. 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). *Quælea quælea*—movements. Unpubl. Rep.: Moshi 25.1.55.
- Haylock, J. W. (1957). Preliminary notes on the Sudanioch (*Quælea quælea aethiopica*) and its control by the Department of Agriculture in Kenya Colony. CCTA/CSA Africa (57) QB 12. CSA Symp. *Quælea*, Livingstone, 1957. CCTA/CSA Joint Secretariat, Bulawayo.
- Haylock, J. W. (1959). *Investigations on the habits of quælea 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 Annu. Tech. Meet.*, FAO/UNDP Regional Quælea 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'enrobage 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., Niquin, 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 carrion crow. *Ibis*, **112**, 397–400.
- Hoopland, 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 Haegert, M. A. (1984). Handbook of toxicity of pesticides to wildlife. *USFWS Resour. Publ.* 153.
- Huffman, 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 Afric. Symp.* (eds. E. N. Wright, I. R. Inglis, and C. J. Pearce). 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 quælea in the Lake Chad Basin and the Benoue Watershed in Tchad and Cameroon. Unpubl. Internal Rep., FAO/UNDP Quælea Project RAF/73/055, FAO, Rome.

- Jackson, J. and Park, P. O. (1973). The toxic effects of fenthion on a nesting population of quæleas 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 Quælea Project RAF/73/055, FAO, Rome.
- Jackson, J. J. (1974a). Nesting success of *Quælea quælea* with one parent removed and observations on roosting behavior, with implications for control. *Proc. 6th Vertebr. Pest Conf.*, Anaheim, California, **6**, 242–5.
- Jackson, J. J. (1974b). A trap for fledgling *Quælea quælea*. Unpubl. Internal Rep., FAO/UNDP Quælea Project RAF/73/055, FAO, Rome.
- Jackson, J. J. (1974c). The relationship of Quælea migrations to cereal crop damage in the Lake Chad basin. *Proc. 6th Vertebr. Pest Conf.*, Anaheim, California, **6**, 238–42.
- Jackson, W. B. (1979). Subcommittee on the estimation of bird damage to grain crops. *Min. 1st Annu. Tech. Meet.*, FAO/UNDP Regional Quælea Project RAF/77/042.
- Jackson, W. B. and Jackson, S. S. (1977). Estimates of bird depredations to agricultural crops and stored products. Plant Health Newslett.: Colloquium on crop protection against starlings, pigeons, and sparrows. *EPPO Publ. Ser. B*, **84**, 33–43.
- Jaeger, M. E. and Jaeger, M. M. (1977). Quælea as a resource. Unpubl. Internal Rep., FAO/UNDP Quælea Project RAF/73/055, FAO, Rome.
- Jaeger, M. M. (1984). Seasonal distribution and movement patterns of quælea in eastern Africa: A current perspective. *Proc. 5th Annu. Tech. Meet.*, FAO/UNDP Regional Quælea 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 quælea *Quælea quælea* 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 *Quælea quælea* in eastern Africa (July 1978–October 1981). Mask index and the distribution of quælea. *Proc. 3rd Annu. Tech. Meet.*, FAO/UNDP Regional Quælea 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 quælea nesting colonies (1976–1979). *Proc. 9th Vertebr. Pest Conf.*, Fresno, California, **9**, 21–8.
- Jaeger, M. M. and Erickson, W. A. (1981). Lethal control of quælea nesting colonies in the Awash Valley during 1981. *Proc. 3rd Annu. Tech. Meet.*, FAO/UNDP Regional Quælea Project RAF/77/042, pp. 62–63.
- Jaeger, M. M., Erickson, W. A., and Jaeger, M. E. (1979). Sexual segregation of red-billed quæleas (*Quælea quælea*) 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. Mid. Nat.*, **111**, 319–31.
- James, H. W. (1928). The nesting of the southern pink-billed weaver (*Querula quelea luteinucha*). *Oologist's 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 Kirkeby, 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. Kendaligh). Cambridge University Press, Cambridge, England, pp. 15–51.
- Jones, P. J. (1972). The status of *Querula 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 *Querula quelea*. *Ibis*, **118**, 575–6.
- Jones, P. J. (1980). The annual mortality of *Querula 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 *Querula 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 *Querula quelea*. *Ibis*, **118**, 547–74.
- Jones, P. J. and Ward, P. (1979). A physiological basis for colony desertion by red-billed queleas (*Querula 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.
- Kalmbach, 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.
- Kaske, R. F. (1970). Trials to control weaver-birds by non aerial operations in the Sudan. Unpubl. Internal Rep., GAWI, Frankfurt, West Germany; PPD Khartoum.
- 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**, 2292–302.
- 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., Punnecock, 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 *Querula quelea*. *Ibis*, **115**, 600–01.
- Kendaligh, S. C. and West, G. C. (1965). Caloric values of plant seeds eaten by birds. *Ecology*, **46**, 533–5.
- 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. Farner). 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 Quelca 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 Quelca 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 Quelca Project RAF/77/042.
- Klopfer, P. H. (1958). Influence of social interactions on learning rates 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 News*, **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.
- 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. *Malimbus*, 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.
- Lawton, 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. 2.1/1-2.1/11.
- 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 aethiopica* in Sudan 1979-1980. *Min. 2nd Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/77/042.
- Leuthold, D. and Leuthold, B. (1972). Blutschuhabebber *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.
- Loftis, B. (1962). Photoperiod and the refractory period of reproduction in an equatorial bird (*Quelea quelea*). *Ibis*, 104, 407-14.
- Loftis, B. (1964). Evidence of an autonomous reproductive rhythm in an equatorial bird (*Quelea quelea*). *Nature (Lond.)*, 201, 523-4.
- Louhan, J. and Tanim, S. (1980). Do roosts serve as 'information centers' for crows and ravens? *Am. Nat.*, 115, 284-9.
- Lourens, D. C. (1957). Parathon 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. Wild. 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/81/03, 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.
- Mabobjayad, 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.
- MacCullagh, R. G. (1984). Terminal report of avian toxicologist. *Proc. 5th Ann. Tech. Meet.*, FAO/UNDP Regional Quelea Project RAF/81/023, pp. 19-25.
- MacCullagh, 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-Océanique 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.

- Manikowski, S. (1981). Les résultats d'études sur les *Quielea queleae* dans le delta central du Niger. Unpubl. Internal Rep., FAO/UNDP Quielea Project RAF/77/047, FAO, Rome.
- Manikowski, S. (1984). Birds injurious to crops in West Africa. *Trop. Pest Manage.*, **30**, 349–87.
- Manikowski, S. (1988). Aerial spraying of quielea. *Trop. Pest Manage.*, **34**, 133–40.
- Manikowski, 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 Quielea Project RAF/73/055, FAO, Rome.
- Manikowski, S. and Da Camara-Smeets, M. (1975b). Observations sur les dégâts d'oiseaux dans la zone de Maroua-Lere-Pala. Unpubl. Internal Rep., FAO/UNDP Quielea Project RAF/73/055, FAO, Rome.
- Manikowski, S. and Da Camara-Smeets, M. (1979a). Estimating bird damage to sorghum and millet in Chad. *J. Wildl. Manage.*, **43**, 540–4.
- Manikowski, S. and Da Camara-Smeets, M. (1979b). Préférences alimentaires chez *Quielea queleae* (L.). *Terre Vie*, **33**, 61–22.
- Marshall, A. J. and Disney, H. J. de S. (1956). Photostimulation of an equatorial bird (*Quielea queleae*, Linnaeus). *Nature (Lond.)*, **177**, 143–4.
- Marshall, A. J. and Disney, H. J. de S. (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 cereal 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 antranilate 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 quielea 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 white 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 Glennie, 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). *Roberts 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.*, 100.
- 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 Kirkland'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 *Quielea queleae* in Africa. Unpubl. Internal Rep., FAO/UNDP Regional Quielea Project RAF/81/023.
- Meinzingen, W. (1983). Comparison study of droplet behaviour with an application rate of 2 l and 4 l/ha. Unpubl. Internal Rep., FAO/DLCO-EA.
- Meinzingen, W. (1984). Effect of different application rates in quielea control in Ethiopia 1984. *Proc. 8th Annu. Tech. Meet.*, FAO/UNDP Regional Quielea Project RAF/81/023, pp. 54–6.
- Meinzingen, W. and Laitgo, A.A.R. (1986). A new technique for mass-marking of quielea (*Quielea queleae*). *Proc. 1st Quielea Tech. Meet.*, Desert Locust Control Organization for Eastern Africa, Nairobi, Kenya.
- Mierzejewski, K. (1981). The physics of aerial and groundbased spraying for quielea control. Unpubl. Internal Rep., FAO/UNDP Regional Quielea 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). Prospectus and classification of the ploceine weaver-birds, Part I and Part II. *Ibis*, **102**, 298–321;443–71.
- Morel, G. (1965). La riziculture et les oiseaux dans la vallée du Sénégal. *Congr. Proj. Cultures Trop.*, Marseille, pp. 640–2.

- Morel, G. (1968). L'impact écologique de *Querula querula* (L.) sur les savanes sahariennes raisons du pullissement de ce pioceide. *Terre Vie*, 1, 69-98.
- Morel, G. and Bourlière, F. (1955). Recherches écologiques sur *Querula querula querula* (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 *Querula querula querula* (L.) de la basse vallée du Sénégal. II. La reproduction. *Alauda*, 24, 97-122.
- Morel, G., Morel, M.-Y., and Bourlière, F. (1957). The black-faced weaver bird or dioch in West Africa: an ecological study. *J. Bombay Nat. Hist. Soc.*, 54, 811-25.
- Morel, G. J. and Morel, M.-Y. (1978). Recherches écologiques sur une savane sahélienne du Ferlo septentrional, Sénégal. Etude d'une communauté avienne. *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 Senegambie. *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., Schalter, 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. *Pakistan Agric. Res. Council*, Islamabad, Pakistan, Unnumbered Rep.
- Munck, 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. Martin). ICRISAT, Patancheru, A. P., India, pp. 565-70.
- Murton, R. K. (1965). Natural and artificial population control in the woodpigeon. *Am. Appl. Biol.*, 55, 177-92.
- Murton, R. K. and Westwood, N. J. (1977). *Avian breeding cycles*. Oxford University Press, Oxford, UK.
- Nakamura, K. and Matsuoaka, S. (1983). The food-searching and foraging behaviours of rufous turtle dove, *Streptopelia orientalis* (Lathem), in soybean fields. *Proc. 9th Bird Control Semin.*, Bowling Green, Ohio, 9, 161-6.
- Naude, T. J. (1955a). The quelea problem in the Union of South Africa CCTA/CSA Retiriat Conjoint CCTA/CSA, Bukavu.
- Naude, T. J. (1955b). Quelea control South Africa. Foreign correspondence, Vol. I, 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/73/055, FAO, Rome.
- Ndiaye, A. (1979). OCLALAV experience in the field of bird control in West Africa. *Min. 1st 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 Ouadi Rime-Ouadi 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, 283-312.
- 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., Knittle, 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. *Span.*, 17, 126–8.
- Park, P. O. (1975). The socio-economic effects of the control of grain-eating birds. Unpubl. Internal Rep., FAO/UNDP Quelca Project RAF/73/055, FAO, Rome.
- Park, P. O., Adam, J., and Lubazo, R. (1975). Trials of repellency for the protection of sorghum at Deli. Unpubl. Internal Rep., FAO/UNDP Quelca 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 Quelca Project RAF/73/055, FAO, Rome.
- Park, P. O. and Assagninou, W. (1973). Trials at Deli of chemical repellents to protect sorghum against grain-eating birds. Unpubl. Internal Rep., FAO/UNDP Quelca Project RAF/73/055, FAO, Rome.
- Parker, J. D. (1986). A novel sprayer for the control of quelca 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 Quelca 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 Madama Sarah (*Placens cucullatus*) 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 Quelca Project RAF/73/055, FAO, Rome.
- Perrins, C. M. (1970). The tunting of birds' breeding seasons. *Ibis*, 112, 242–55.
- Perumal, R. S. and Subramanian, T. R. (1973). Studies on panicle 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, *Quelca quela laitmani*, 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/EPPC Bull.*, 3, 107–10.
- Pinowski, J., Tomick, 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* (cds. 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., Nyamandhlivo.
- Plowes, D.C.H. (1955). Queleas in Southern Rhodesia, CCTA/CSA Africa (55) 121. CSA Réunion des Spécialistes du Quelca, 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.
- Popc, G. G. and King, W. J. (1973). Spray trials against the Red-billed Quelca (*Quelca quelea*) in Tanzania. Misc. Rep. 12, Centre for Overseas Pest Research, London, UK.
- Popc, G. G. and Ward, P. (1972). The effects of small applications of an organophosphorus poison, fenthion, on the weaver-bird *Quelca quelea*. *Pestic. Sci.*, 3, 197–205.
- Power, D. M. (1970). 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., Rogier, 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 Scyoc, 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*. *Phytochemistry*, 7, 1583–92.
- Raju, A. S. and Shivanarayana, N. (1980). Extent of damage in some early rice varieties due to bird pests at Marueru. *Int. Rice Comm. Newslett.*, 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 graminéens 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. Farner). National Research Council, Washington, D.C.
- Roberts, N. (1909). *Pyromelana oxyx* 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. Feare). 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 Rosa Pinto, A. A., da Castro, no. 5. Lourenco Marques. *Melloramento*, **13**, 79-113.
- Rosa Pinto, A. A., da Lamm, D. W. (1960). Memórias 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.
- Schaefer, E. W., Jr. and Brunton, R. B. (1971). Chemicals as bird repellents: two promising agents. *J. Wildl. Manage.*, **35**, 569-72.
- Schaefer, E. W., Jr., Brunton, R. B., Lockyer, N. F., and De Grazio, J. W. (1973). Comparative toxicity of seventeen pesticides to the *Querula*, 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 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, *Acridotheres tristis* (L.). *J. Bombay Nat. Hist. Soc.*, **70**, 204-6.
- Serrurier, A. (1965). Ecologie du *Querula querula querula*. *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.
- Sheffie, 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 pest. *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 Schafner, E. W., Jr. (1976). Behavioral response of quelea to methiocarb (Mesurof®). *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 Palaeartic 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, BCPC 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, Livingston*, 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.
- Stresmann, E. (1965). Die Mauser der Huchnervogel. *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. Djiteye). Centre for Agricultural Publishing and Documentation, Wageningen, pp. 37–51.
- Sultana, P., Brooks, J. E., and Bruggers, R. L. (1986). Repellency and toxicity of bird control chemicals to pest birds in Bangladesh. *Trap. 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. (1936). The birds of Irene, near Pretoria, Transvaal. *J. S. Afr. Ornithol. Union*, **2**, 55–83.
- Thiollay, J. M. (1975). Exemple de prédation naturelle sur une population nicheuse de *Quielea qu. quelea* L. au Mali. *Terre Vie*, **29**, 31–54.
- Thiollay, J. M. (1978a). Production et taux de mortalité dans les colonies de *Quielea quelea* (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 Ann. 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 Dundo, Lisbon.
- Treca, B. (1976). Les oiseaux d'eau et la riziculture dans le Delta du Sénégal. *Oiseau Rev. Fr. Ornithol.*, **45**, 259–65.
- Trec, A. J. (1962). The birds of the Leopardshill area of the Zambezi escarpment. *Ostrich*, **33**, 3–23.
- Uk, S. and Munka, S. (1984). Fenethion residues in quelea birds from experimental aerial spraying of Quelictox 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 Ee, C. A. (1973). Cattle egrets prey on breeding queleas. *Ostrich*, **44**, 136.
- Van Sommeren, 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 *Quielea quelea* in Nigeria. *Ibis*, **107**, 173–214.

- Ward, P. (1965b). The breeding biology of the black-faced dioch *Quelea quelea* in Nigeria. *Ibis*, **107**, 326-49.
- Ward, P. (1965c). Biological implications of quelea control in West Africa. *Congrès de la Protection des Cultures Tropicales* 661-6, Marseilles.
- Ward, P. (1965d). Seasonal changes in the sex ratio of *Quelea quelea* (Ploceidae). *Ibis*, **107**, 397-9.
- Ward, P. (1966). Distribution, systematics, and polymorphism of the African weaverbird (*Quelea quelea*). *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. (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 *Quelea quelea* 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*. AGPR-RAF/67/087 Working Paper (Manual), United Nations Development Programme/FAO, Rome.
- Ward, P. (1978). The role of the crop among red-billed queleas *Quelea quelea*. *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 *Quelea quelea* (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 *Quelea quelea* (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 WARDA/TAT/83/ARR-8A.
- Weatherhead, P. J. (1983). Two principal strategies in avian communal roosts. *Nat. Nat.*, **121**, 237-43.
- Weatherhead, P. J., Tinker, S., and Greenwood, H. (1982). Indirect assessment of avian damage to agriculture. *J. Appl. Ecol.*, **19**, 773-82.
- Weidner, T. (1983). Why do pesticides cost so much \$\$\$? *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**, 63-82.
- Wiens, J. A. and Dyer, M. I. (1977). Assessing the potential impact of granivorous birds in ecosystems. In *Granivorous birds in ecosystems* (eds. J. Pinowski and S. C. Kendal). 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. Pinowski and S. C. Kendal). 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 Williamson, 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 *Quelea quelea*. *Nature (Lond.)*, **184**, 1658-9.
- Woroniecki, P. P. and Dolbeer, R. A. (1980). The influence of insects in bird damage control. *Proc. 9th Verteb. Pest Conf.*, Fresno, California, **9**, 53-9.
- Woroniecki, P. P., Dolbeer, R. A., and Stehn, R. A. (1981). Response of blackbirds to Mesurol and Sevin applications on sweet corn. *J. Wildl. Manage.*, **45**, 693-701.
- Woroniecki, P. P., Stehn, 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. Feare). 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 (*Quelea quelea ethiopica*) in the Sudan. *CSA Symp. Quelea*, Livingstone, 1957. CCTA/CSA Joint Secretariat, Bukavu.
- Yates, F. and Zaconpanay, B. A. (1935). 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 Otterman, J. (1977). The microclimate of winter roosts of the starling *Sturnus vulgaris*. *Ibis*, **119**, 366-8.
- York, J. O., Howe, D. F., Bullock, R. W., Nelson, T. S., and Stallcup, 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., Bullock, R. W., Nelson, T. S., and Stallcup, O. T. (1983). Dry matter digestibility in purple testa sorghums. *Proc. 37th Annu. 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). Tropfengroßanalyse unter besonderer Berücksichtigung der Zersetzung im chemischen Pflanzenschutz. Dissert. Tech. Univ. Berlin.
- Zeinelabdin, M. H. (1980). The potential of vegetable tannin as a bird repellent. Unpubl. M.A. thesis, Bowling Green State University, Bowling Green, Ohio.
- Zeinelabdin, 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.