All The Birds of Africa

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The Birds of Africa terminé. L'objectif de cette courte évaluation est de marquer la parution du septième et dernier tome de *The Birds of Africa* et de célébrer la fin de ce projet, qui a duré 25 ans. En touchant à certaines difficultés d'ordre taxonomique et autres, en présentant des cartes et en examinant les sources bibliographiques, nous tentons de placer cette œuvre dans la perspective de l'ornithologie africaine contemporaine.

Our purpose in this brief appraisal is to mark the publication of the seventh volume of *The Birds of Africa* and to celebrate the completion of the 25-year project. In touching upon some taxonomic and other difficulties, in presenting maps and discussing literature sources, we try to place the work in perspective with African ornithology today.

The history of this multi-volume handbook has been outlined in the introduction to the seventh and final volume¹⁵ and by Fry & Woodcock¹⁶. In the 1970s Leslie Brown developed ideas for a definitive handbook on Africa's avifauna in discussion with Emil Urban in Ethiopia and Kenneth Newman in South Africa. It was conceived as a two-volume work to occupy him in his retirement and would be the modern successor to Reichenow³⁰, Sclater³² and Mackworth-Praed & Grant²³⁻²⁵. Finding a publisher willing to take the considerable commercial risk took many years. Eventually, Academic Press agreed to it in 1976, but negotiations continued and late in 1978 a work of four volumes was agreed upon. Writing commenced immediately. Unhappily, Leslie Brown died in 1980, long before the first volume³ appeared. It necessitated some reorganisation of the book, published in 1982, and restructuring of the remainder as an edited, multi-author, series. Martin Woodcock became sole colour artist and Ian Willis the principal line artist. Hilary Fry and Stuart Keith, members of the first volume's Advisory Editorial Board, were appointed editors jointly with Emil Urban. The new team straightaway persuaded Academic Press to expand the series to six volumes, three non-passerine and three passerine. Later, the need for a fourth passerine volume became apparent, bringing the final total to seven.

Natural history book publishing was a new field for Academic Press in the 1970s. Nowadays a publisher would doubtless require an extremely detailed and convincing business plan before agreeing to embark upon such a major venture, and it is greatly to the credit of Academic Press that they agreed to proceed with *The Birds of Africa* (hereafter simply *BoA*) and that they persevered when the first three or four volumes were commercially barely viable at all. If it were not for Leslie Brown's powers of persuasion and for Academic's constant support during the trials and tribulations of so many years, *BoA* would simply never have come into existence.

After Vol 1, it became increasingly evident that production of BoA was as slow as the slowest contributor, and successive interims between volumes 2⁴¹, 3¹³, 4²⁰ and 5⁴³ were of two, four and five years. To speed matters up, Hilary Fry was appointed Executive Editor of the last two volumes^{14,15}, and sectional or 'horizontal' as well as systematic or 'vertical' research and authorship were initiated, with David Pearson responsible for most Descriptions and Stuart Keith for most of the Voice and Field Characters sections. Vol 6 was able to appear only three years after Vol 5. Despite some delays consequent upon Vol 7 being put up for sale (along with most other natural history titles) by Academic Press's new owners in 2002, the final volume was delivered to its new publishers, Christopher Helm / A & C Black, a mere 21 months after the appearance of Vol 6. Unfortunately Stuart Keith did not live to see the completion of the series; he died in February 2003⁴⁶, having finished his contribution but denied the pleasure of seeing any of it in proof.

Looking back, we are inclined to think that the circumstances that made *BoA* so protracted meant that nothing short of a miracle could ever have shortened the production schedule by more than a year or two. With editors, authors, field workers and correspondents scattered worldwide and often on the move, communication was always a problem, but regular week-long meetings of editors and

artists with the publishers in London served to keep the team functioning smoothly.

Objectives

During its long life BoA's objectives have remained unchanged: to integrate salient facts from field, literature and museum, and to produce a compendium characterising the lives and biology of every species. In pursuing them, the project has had to keep abreast of the accelerating pace of events. These include geopolitical changes across the face of Africa and the consequent imperative for nature conservation; increasing tourism and great improvement in knowledge about bird identification and distribution; a spectacular increase in university-led research in South Africa; an exponential growth in ornithological publications; and global developments in information and communication technology and molecular biology.

Design and format

In trying to keep up with all of these developments, progressive material and presentational changes have been introduced with each volume, in such features as species account length, text figures, plate keys, colour maps, mapping precision, voice transcriptions, reference systems and indexing. Despite these changes, inevitable in the passage of so many years, despite the deaths of two editors and several other contributors, and despite far-reaching changes in publisher and production, we believe that the integrity of the series has remained intact. Design and format have kept sufficiently unchanged for the seven volumes to be quite recognisable as a series essentially uniform in presentation and artistry. In the absence of photographs, Ian Willis's meticulous line drawings have enlivened the text throughout. Both he and Martin Woodcock have drawn and painted African birds in the field, as well, of course, as using a variety of other source material. Martin has made frequent visits to Africa expressly for BoA, with artistic results that his colleagues think and BoA's reviewers declare have added greatly to the work's attractiveness.

Relationships and classification

Molecular biology has brought about a revolution in systematics and taxonomy, to the point where the very nature of the 'species' is being constantly re-evaluated^{6,19,28,31,38}. Most of the *BoA* team has been acutely interested in taxonomy, species relationships and generic boundaries. Whilst organising the birds around conventional systematic arrangements, we have made a point of reassessing their taxonomy throughout, making wide use of the superspecies concept which earlier African studies did so much to promote on the world stage^{17,36}. By no means have editors always agreed with an author's preferred arrangement, nor have they always agreed with each other. It can probably be said that over its quarter century BoA has not been consistent in its taxonomic/systematic approach: hardly surprising, since the 100 contributors had as many different opinions. At least we have attempted to justify decisions with mini-essays in the Introductions to several volumes and evolutionary/ biogeographical case studies in Vols 6 (p xiv) and 7 (p xvi), by cross-references in numerous species texts, and with explanations in the taxonomic diagnoses.

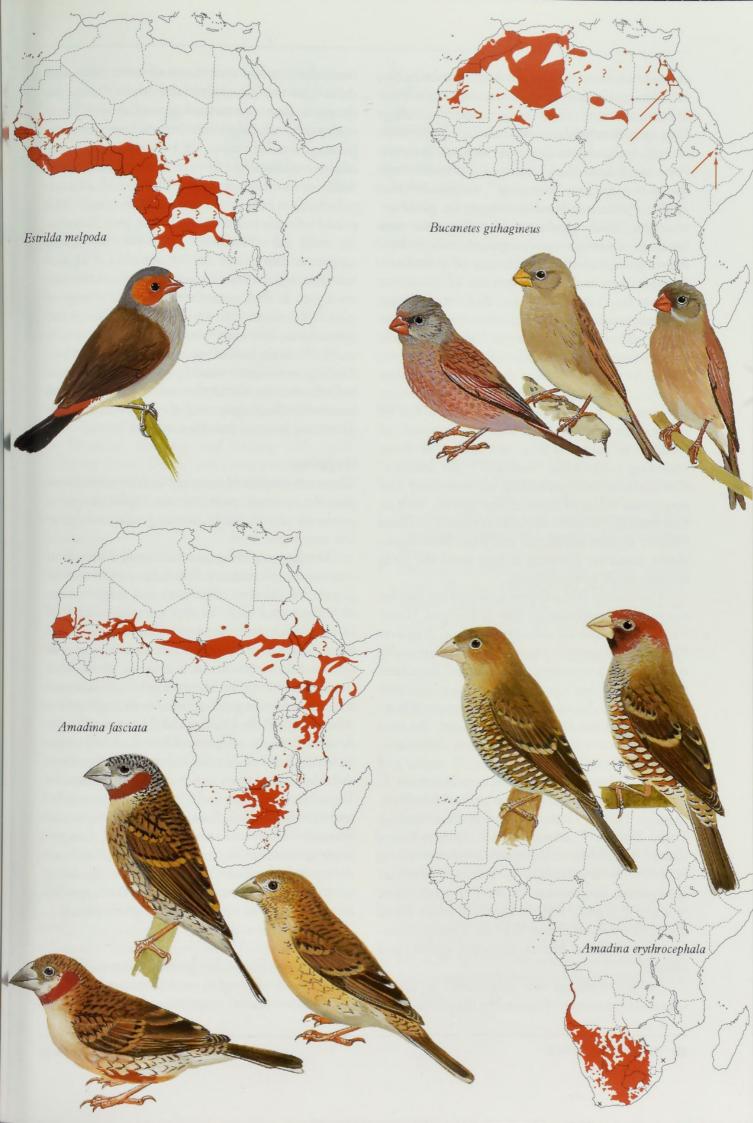
Taxonomy

In every volume many innovations have been made, raising some birds from subspecies to allospecies (members of a superspecies), sinking others, splitting and combining genera, and recognising, eg, picathartes Picathartidae, sugarbirds Promeropidae and oxpeckers Buphagidae as constituting full families (these three being endemic to Africa). In Vol 7 reasons are given for treating Compact Weaver *Pachyphantes superciliosus* as a weaver curiosity and Bob-tailed Weaver *Brachycope*

Caption to plate on opposite page

Plate 1. Representative maps from *The Birds of Africa* Vol 7: in West and Central Africa (Orange-cheeked Waxbill *Estrilda melpoda*), Saharan Africa (Trumpeter Finch *Bucanetes githagineus*), Sahel zone, East and southeast Africa (Cut-throat Finch *A. fasciata*), and southern Africa (Red-headed Finch *Amadina erythrocephala*). Multiple images per species are of different subspecies, genders or ages.

Cartes de distribution représentatives de *The Birds of Africa* Vol 7: Afrique de l'Ouest et centrale (Astrild à joues oranges *Estrilda melpoda*), Afrique saharienne (Roselin githagine *Bucanetes githagineus*), Sahel, Afrique de l'Est et du sud-est (Amadine cou-coupé *Amadina fasciata*), et Afrique australe (Amadine à tête rouge A. *erythrocephala*). Plusieurs images par espèce indiquent soit des sous-espèces différentes, soit des sexes différents ou différentes classes d'âges.



anomala as distinct from bishops Euplectes, for considering Cuckoo-finch Anomalospiza imberbis to be an aberrant viduid Vidua²¹, and for treating Carpospiza brachydactyla as a finch (Pale Rockfinch: Fringillidae) and not a sparrow (Pale Rock Sparrow: Passeridae). Also in Vol 7, taxonomically additional species of antpeckers Parmoptila47, waxbills Estrilda, pytilias Pytilia, quailfinches Ortygospiza, paradisewhydahs Vidua, grosbeaks Rhynchostruthus and buntings Emberiza are recognised, and Robert Payne gives authoritative account of a firefinch Lagonosticta and three species of parasitic indigobirds Vidua that he has discovered. Many BoA taxonomic judgements in later volumes are supported by molecular evidence. Others may prove to be ill-founded. With the benefit of hindsight, we might like to revise some of the opinions in earlier volumes, in relation to superspecies composition for instance. For that matter, we would like to revise some statements in later volumes too, in relation to such exciting revelations as those regarding sunbird-like 'warblers'33, for instance. Controversy will continue to surround the taxonomic status of some of our species, such as Red Sea Cliff Swallow Hirundo perdita, Usambara Hyliota Hyliota usambarae and Bulo Burti Bushshrike Laniarius liberatus, at least until the birds become much better known.

The various BoA volumes appeared too late for newly discovered species like Udzungwa Forest Partridge Xenoperdix udzungwensis and Nechisar Nightjar Caprimulgus solala. Some taxonomically cryptic birds now recognised as species³⁵ have been treated by BoA as subspecies. They include Northern Black Korhaan Eupodotis afraoides, Southern Whitefaced Scops Owl Ptilopsis (Otus) granti, the four red-billed hornbills, Damara Tockus damarensis, Southern T. rufirostris, Tanzanian T. ruahae and Western T. kempi (recently split from Northern T. erythrorhynchus), 12 larks, three pipits, 11 bulbuls, Príncipe Thrush Turdus xanthorhynchus (from São Tomé Thrush T. olivaceofuscus), Eastern Forest Robin Stiphrornis xanthogaster/sanghensis (from Western S. erythrogaster), Bangwa Warbler Bradypterus bangwaensis (from Evergreen-forest Warbler B. lopezi), African Desert Warbler Sylvia deserti (from Asian Desert Warbler S. nana, a nonbreeding visitor to Africa), cisticolas, apalises and others.

Perhaps some of the judgements in earlier volumes were overly influenced by the editors' own

researches, on the systematics of some ibises and doves¹², jacanas¹⁶, nightjars⁹ and others. At least the species accounts concerned give a flavour of how such studies, in relation to voices, nest structure, plumage and behaviour, are well within the ambit of observers hoping to give their African visit some really rewarding purpose. We found African tailorbirds to be thinly disguised Asian ones^{10,43} and joined others in thinking that tit-babblers Parisoma are really Sylvia warblers43 (but were only mildly suspicious that Sylvia are not warblers at all but babblers, which they now prove to be5). Such ideas are legion in BoA, sometimes causing a change of mind between volumes: Cape Grassbird Sphenoeacus afer may also be a babbler, not a warbler⁴²; in the bulbul volume, 4, we thought that Neolestes and Nicator would prove to be shrikes not bulbuls, but by the shrike volume, 6, they had become bulbuls again and the lucky birds were illustrated but not described in both books.

Mapping

The much-improved accuracy with which it is now possible to map most African birds' ranges is extremely important in assessing relationships at low taxonomic level.

The Range and Status section and distribution map are complementary. R & S data, with notes on population density, migrations and conservation, were abstracted from the ever-growing number of fine regional and country avifaunal guides and atlases (of which the most notable ones^{2,8,39} appeared too recently to be of much help for BoA). Each successive BoA volume has benefited from additional atlases, culminating in the great The Atlas of Southern African Birds¹⁸. BoA Vols 6 and 7 have particularly detailed maps, drawn from published country ranges including hitherto-overlooked data for Mauritania and Mali²², and from not-yet-published maps for Tanzania, Cameroon and Central Africa, compiled respectively by Neil Baker, Robert Dowsett and Françoise Dowsett-Lemaire, and Marc Languy. Some species and their ranges, all from Vol 7, are shown here in Plates 1 and 2, the maps being selected to demonstrate the precision made possible in most countries by currently available atlases.

Voice

This became Stuart Keith's department. He was exceptionally talented in rendering transliterations of voices in a realistic, evocative and often humorous manner. He made best use of increasingly informative sound-record publications and corresponded at length with their authors to ensure accuracy of identification. It culminated in his close co-operation with Claude Chappuis, whose recent, comprehensive collection of high-quality recordings place his work⁴ amongst the most valuable publications of *BoA*'s time.

Behaviour, biology, literature

At some 4,720 pages overall, it goes without saying that BoA has leant very heavily on the observations of contemporary ornithologists in field, museum and studio, and upon the thousands of people whose work is already entrenched in papers, books, sound recordings, maps and photographs. BoA has been fortunate in numbering amongst its contributors many university and museum scientists who are respected and acknowledged authorities on particular families or species. Keeping abreast of the literature, however, and writing with equal authority about birds on one's own patch as well as elsewhere in Africa, has proved difficult for some authors lacking ready access to libraries and skin collections. That is where editorial input becomes imperative.

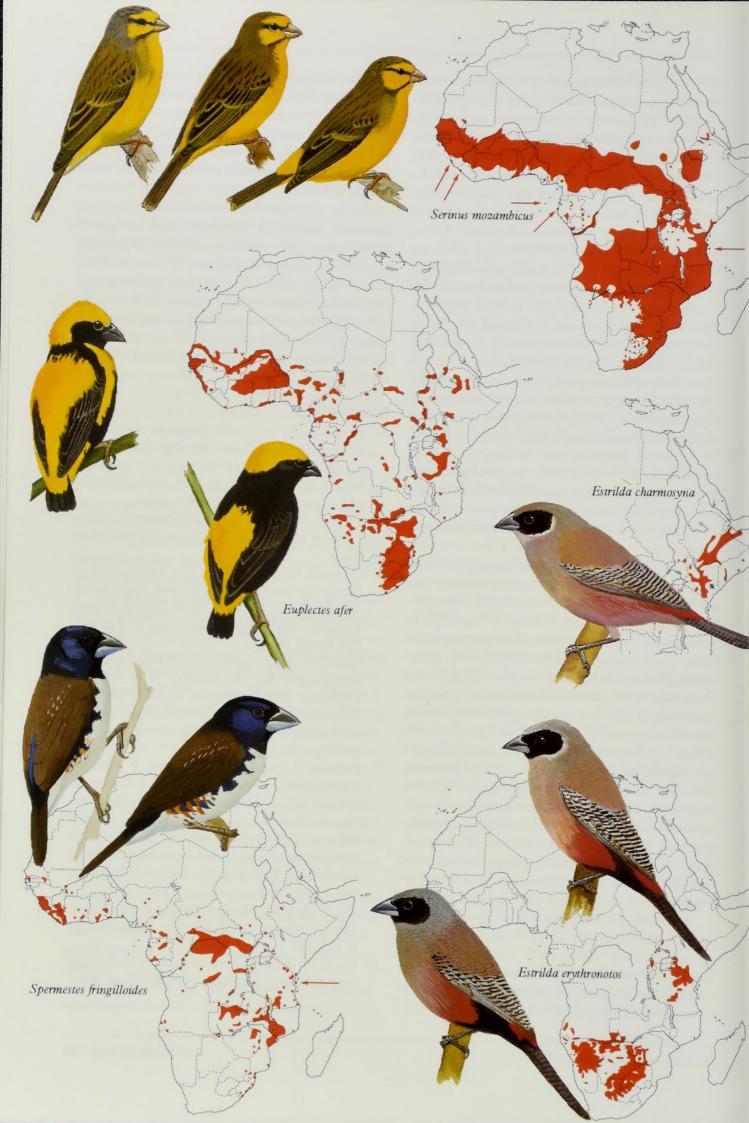
Here we would like to pay tribute again to the fieldwork of dedicated earlier naturalistornithologists, such as CW Benson¹, RE Moreau²⁷, W Serle³⁴, J Vincent⁴⁵, A W Vincent⁴⁴ and V G L van Someren³⁷ (the references are only examples of their publications). The wealth of their unsophisticated but hard-won life-history observations of hundreds of species remains unsurpassed, and remains an inspiration to this day. There are dedicated and skilled observers today, like Robert Dowsett, Françoise Dowsett-Lemaire, Robert Payne²⁹, Peter Steyn⁴⁰ and Warwick Tarboton⁴¹, but a market for fact-packed natural histories in the style of van Someren's³⁷ no longer exists and it is only a few journals (like this one) that promote the publication of natural history observations, the unpopular middle ground between rigorously scientific ornithology and popular birding.

Such has been the growth of knowledge in African ornithology in recent decades that species accounts have sometimes fallen short of encompassing everything known. Moreover, in earlier volumes an account length limitation had to be imposed by the publishers. When it was lifted, passerine accounts were able to become more detailed than those for the non-passerines. All the same, some species accounts are remarkably short, a reflection of just how little is known. If discovery is your desire, you have only to scan the pages for section brevity to identify good reasons for your next field trip.

All in all, however, we feel that a stronger systematic edifice has been built which can give a better understanding of the evolution of Africa's wonderfully diverse bird fauna. What is needed now is first (a mere trifle) revision, updating and expansion of *BoA*'s earlier volumes, and second, new avifaunal and biogeographical analyses like Moreau's²⁶ some 40 years ago. These are future enterprises for the rising generation of African ornithologists.

References

- Benson, C.W. 1945–1947. Notes on the birds of southern Abyssinia. *Ibis* 87: 366–400, 489–509; 88: 25–48, 180–205; 89: 29–50.
- 2. Borrow, N. and Demey, R. 2001. *Birds of Western Africa*. London, UK: Christopher Helm.
- 3. Brown, L.H., Urban, E.K. and Newman, K. 1982. *The Birds of Africa*. Vol 1. London, UK: Academic Press.
- Chappuis, C. 2000. African Bird Sounds: Birds of North, West and Central Africa and Neighbouring Atlantic Islands. 15 CDs. Paris, France: Société d'Etudes Ornithologiques de France & London, UK: British Library.
- 5. Cibois, A. 2003. *Sylvia* is a babbler: taxonomic implications for the families Sylviidae and Timaliidae. *Bull. Br. Ornithol. Cl.* 123: 257-261.
- Collinson, M. 2002. Comment—a written constitution for species-level taxonomy. *Br. Birds* 95: 370–371.
- 7. Dowsett, R.J. and Dowsett-Lemaire, F. 1993. A Contribution to the Distribution and Taxonomy of Afrotropical and Malagasy Birds. Liège, Belgium: Tauraco Press.
- 8. Fishpool, L.D.C. and Evans, M.I. (eds) 2001. *Important Bird Areas in Africa and Related Islands*. Cambridge, UK: BirdLife International & Newbury: Pisces Publication.
- Fry, C.H. 1988. Skulls, songs and systematics of African nightjars. *Proc. 6 Pan-Afr. Ornithol. Congr.* 6: 105–131.
- Fry, C.H. 1976. On the systematics of African and Asian tailorbirds (Sylviinae). *Arnoldia (Rhod.)* 8 (6): 1–15.



- 11. Fry, C.H. 1983. The jacanid radius and *Microparra*, a neotenic genus. *Gerfaut* 73: 173–184.
- 12. Fry, C.H., Keith, S. and Urban, E.K. 1985. Evolutionary expositions from 'The Birds of Africa': *Halcyon* song phylogeny; cuckoo host partitioning; systematics of *Aplopelia* and *Bostrychia*. In Schuchmann, K.-L. (ed) *African Vertebrates: Systematics, Phylogeny and Evolutionary Ecology*. Bonn: Zoologisches Forschungsinstitut und Museum Alexander Koenig.
- 13. Fry, C.H., Keith, S. and Urban, E.K. (eds) 1988. *The Birds of Africa*. Vol 3. London, UK: Academic Press.
- 14. Fry, C.H., Keith, S. and Urban, E.K. (eds) 2000. *The Birds of Africa*. Vol 6. London, UK: Academic Press.
- 15. Fry, C.H. and Keith, S. (eds) 2004. *The Birds of Africa*. Vol 7. London, UK: Academic Press.
- 16. Fry, C.H. and Woodcock, M. 2003. Out of Africa. *Birdwatch* 138: 27–30.
- 17. Hall, B.P. and Moreau, R.E. 1970. An Atlas of Speciation in African Passerine Birds. London, UK: Br. Mus (Nat. Hist.).
- 18. Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. and Brown,

Caption to plate on opposite page

Plate 2. Representative maps from *The Birds of Africa* Vol 7: a common and widespread wooded-savanna species (Yellow-fronted Canary *Serinus mozambicus*), a fragmented distribution (Yellow-crowned Bishop *Euplectes afer*), a range fragmented because of specialised habitat requirements (Magpie Mannikin *Spermestes fringilloides*, a specialist upon *Oxytenanthera abyssinica* bamboo), and parapatric/allopatric populations of taxonomically controversial status (Black-cheeked Waxbill *Estrilda charmosyna* and Black-faced Waxbill *E. erythronotus erythronotus* and *E. e. delamerei*, a superspecies). Multiple images per species are of different subspecies, genders or ages.

Cartes de distribution représentatives de *The Birds of Africa* Vol 7: une espèce de savanne arborée commune et à large distribution (Serin du Mozambique *Serinus mozambicus*), une distribution fragmentée (Euplecte vorabé *Euplectes afer*), une distribution fragmentée due à des exigences d'habitat spécifiques (Capucin pie *Spermestes fringilloides*, un spécialiste du bambou *Oxytenanthera abyssinica*), et des populations parapatriques/allopatriques au statut taxonomique controversé (Astrild des fées *Estrilda charmosyna* et Astrild à moustaches *E. erythronotos*). Plusieurs images par espèce indiquent soit des sous-espèces différentes, soit des sexes différents ou différentes classes d'âges. C.J. (eds) 1997. *The Atlas of Southern African Birds*. Vols 1 & 2. Johannesburg: BirdLife South Africa.

- 19. Helbig, A.J., Knox, A.G., Parkin, D.T., Sangster, G. and Collinson, M. 2002. Guidelines for assigning species rank. *Ibis* 144: 518–525.
- 20. Keith, S., Urban, E.K. and Fry, C.H. (eds) 1992. *The Birds of Africa*. Vol 4. London, UK: Academic Press.
- 21. Lahti, D.C. and Payne, R.B. 2003. Morphological and behavioural evidence of relationships of the Cuckoo Finch *Anomalospiza imberbis. Bull. Br. Ornithol. Cl.* 123: 113–125.
- Lamarche, B. 1993–1994. Atlas de Répartition des Oiseaux du Mali et de Mauritanie. Vols 1–8. Nouakchott: Association des Naturalistes Sahariens et Ouest-Africaines.
- 23. Mackworth-Praed, C.W. and Grant, C.H.B. 1957– 1960. *Birds of Eastern and North Eastern Africa*. 2 vols. Second edn. London, UK: Longmans.
- 24. Mackworth-Praed, C.W. and Grant, C.H.B. 1962– 1963. *Birds of the southern third of Africa*. 2 vols. London, UK: Longmans.
- 25. Mackworth-Praed, C.W. and Grant, C.H.B. 1970– 1973. *Birds of West Central and Western Africa*. 2 vols. London, UK: Longmans.
- 26. Moreau, R.E. 1966. *The Bird Faunas of Africa and its Islands*. London, UK: Academic Press.
- Moreau. R.E. and Moreau, W.M. 1937. Biological and other notes on some East African birds. *Ibis* 14 (1): 152–174, 321–345.
- Payne, R.B., Hustler, K., Stjernstedt, R., Sefc, K.M. and Sorenson, M.D. 2002. Behavioural and genetic evidence of a recent population switch to a novel host species in brood-parasitic indigobirds *Vidua chalybeata*. *Ibis* 144: 373–383.
- 29. Payne, R.B., Parr, C.S. and Payne, L.L. 2003. Song mimicry, song dialects, and behavioural context of songs in brood-parasitic Straw-tailed Whydahs, *Vidua fischeri. Ostrich* 74: 87–96.
- 30. Reichenow, A. 1900–1903. *Die Vögel Afrikas*. Vols 1–4. Neudamm: Neumann.
- Sangster, G., Knox, A.G., Helbig, A.J. and Parkin, D.T. 2002. Taxonomic recommendations for European birds. *Ibis* 144: 153–159.
- 32. Sclater, W.L. 1928–1930. Systema Avium Aethiopicarum. Vols 1–2. London, UK: British Ornithologists' Union.
- 33. Sefc, K.M., Payne, R.B. and Sorenson, M.D. 2002. Phylogenetic relationships of African sunbird-like warblers: Moho (*Hypergerus atriceps*), Green Hylia (*Hylia prasina*) and Tit-hylia (*Pholidornis rushiae*). Ostrich 74: 8–17.

- Serle, W. 1950, 1954, 1965. [Contributions] to the ornithology of the British Cameroons. *Ibis* 92: 602– 638; 96: 47–80; 107: 60–94.
- 35. Sinclair, I. and Ryan, P. 2003. *Birds of Africa South* of the Sahara. Cape Town: Struik Publishers.
- 36. Snow, D.W. (ed) 1970. An Atlas of Speciation in African Passerine Birds. London, UK: Br. Mus. (Nat. Hist.).
- van Someren, V.G.L. 1956. Days with birds. Fieldiana, Zool. 38: 1–520. Chicago: Chicago Natural History Museum.
- 38. Sorenson, M.D., Sefc, K.M. and Payne, R.B. 2003. Speciation by host switch in brood parasitic indigobirds. *Nature* 424: 928–931.
- 39. Stevenson, T. and Fanshawe, J. 2002. *Field Guide to the Birds of East Africa*. London, UK: T. & A.D. Poyser.
- 40. Steyn, P. 1996. *Nesting Birds*. Vlaeberg: Fernwood Press.
- 41. Tarboton, W. 2001. A Guide to the Nests and Eggs of Southern African Birds. Cape Town: Struik Publishers.
- 42. Urban, E.K., Fry, C.H. and Keith, S. (eds) 1986. *The Birds of Africa*. Vol. 2. London, UK: Academic Press.

- 43. Urban, E.K., Fry, C.H. and Keith, S. (eds) 1997. *The Birds of Africa*. Vol. 5. London, UK: Academic Press.
- 44. Vincent, A.W. 1945–1949. On the breeding habits of some African birds. *Ibis* (11 parts from) 87: 72– 90 to 91: 660–688.
- 45. Vincent, J. 1934–1936. The birds of northern Portuguese East Africa. *Ibis* (ten parts from) 13: 126–160 to 15: 48–125.
- 46. Woodcock, M. 2003. Obituary: Stuart Keith. *Bull. ABC* 10: 150–151.
- Woodcock, M.W. 2003. Systematics and confusion in the genus *Parmoptila*. *Bull. Br. Ornithol. Cl.* 123: 274–277.

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