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A taxonomic review of the genus *Zosterops* in East Africa, with a revised list of species occurring in Kenya, Uganda and Tanzania

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Summary

Species limits among East African white-eyes *Zosterops* are reviewed. Recent molecular studies have revealed that arrangements such as those of Britton (1980), with just three species, and Fry (2000), with four species, are unsatisfactory. Most of the isolated highland forms which have been grouped under *Z. poliogaster* evolved independently and warrant treatment as full endemic species. Forms hitherto treated as subspecies of *Z. senegalensis* have been recovered within two divergent African clades. Within a northern clade *Z. stuhlmanni* appears best split *pro tempore* from *Z. senegalensis* (*sensu stricto*). Within a southern clade, *stierlingi* and *anderssoni* may be treated as subspecies of *Z. anderssoni*. The pale yellow-bellied forms, included until now within *Z. abyssinicus,* were found in a different lineage from northeast African grey-bellied forms, and must be treated under *Z. flavilateralis*. With the inclusion of *Z. vaughani* of Pemba Island this results in a total of eleven East African species. These are listed with details of all constituent subspecies, distributions and synonyms. Occurrence within Kenya, Tanzania and Uganda is summarized in an appendix.

Introduction

The abundance of African white-eye forms, most of them morphologically similar, has long presented problems for taxonomists, in particular the placement of their species limits. Moreau (1957) admitted just three *Zosterops* species for the African mainland: *Z. senegalensis*, with yellow-bellied forms widespread in woodland; a duller *Z. abyssinicus* with grey- or yellow-bellied birds in drier northeastern lowlands; and a rather dull southern *Z. pallidus* with belly grey, green or buff-and-white. The various isolated forms in the highlands of Ethiopia, eastern Kenya and northeast Tanzania with a rich green back, either a grey or bright yellow belly, and typically a broad eye-ring, he included within *Z. senegalensis*, as also did White (1963). But Hall & Moreau (1970) treated these together as a separate montane species *Z. poliogastrus*, and this arrangement of four mainland *Zosterops*, each with a number of subspecies, was followed by Fry (2000), Dickinson (2003) and von Balen (2008). Following Oatley *et al.* (2012), Dickinson & Christidis (2014) separated a fifth species, *Z. virens* from *Z. pallidus* in South Africa.

Recent molecular genetic studies have brought into question the utility of traditional morphological characters in assessing African white-eye relationships. For example, three Gulf of Guinea species placed in the distinctive-looking genus *Speirops* have been found to be nested within *Zosterops*, each aberrant species more closely related to typical *Zosterops* than they are to each other (Melo *et al.* 2011). And the wide-ranging *Z. senegalensis* is clearly polyphyletic, for DNA analyses have recovered

subspecies *stenocricotus* and *stierlingi* in different major African white-eye lineages (Warren *et al.* 2006, Melo *et al.*, *op. cit.*).

In East Africa, Britton (1980) admitted three mainland species: *Z. senegalensis*, with three rich green and yellow-plumaged subspecies in Uganda and western Kenya and two more in Tanzania; the paler *Z. abyssinicus,* with two yellow-bellied subspecies in drier northern and eastern Kenya, extending to northeastern Tanzania; and *Z. poliogastrus*, comprising six isolated montane populations (each considered a subspecies), some yellow-bellied, others grey-bellied. The Pemba Island White-eye, treated as *Z. vaughani* by White (1963), was lumped with *Z. senegalensis* by Hall & Moreau (1970) and by Britton (1980), but returned to species status by Zimmerman *et al.* (1996) and later authors. Based on vocal differences and ecology, some of the highland isolates have recently been considered worthy of full species status, e.g. by Collar *et al.* (1994) and Borghesio & Laiolo (2004). The latest IOC World List (Gill & Donkster 2016) splits *Z. kikuyuensis* and *Z. sylvanus* (but not other forms) from *Z. poliogaster*.

The genetic phylogeny of East African white-eyes

DNA investigations of the East African *Zosterops* taxa have recently been published by Habel *et al.* (2013, 2015), Cox *et al.* (2014) and Meimberg *et al.* (2016). Studies using two mtDNA genes revealed extensive non-monophyly in all three mainland species (Cox 2013, Cox *et al.* 2014). Some endemic montane populations were shown to be more closely related to forms with other habitat and elevation preferences, and dispersal abilities, than to restricted populations in neighbouring forest fragments. Most would thus appear to have arisen independently as a result of niche divergence rather than as relics of an ancestral montane population. Most of the 'sky island' forms of Kenya and northern Tanzania were densely sampled, and strong support was found for the monophyly of each one. The forms *mbuluensis, silvanus, eurycricotus, winifredae* and *kikuyuensis,* all hitherto accommodated within *Z. poliogastrus,* formed independent well-supported clades, polyphyletic with respect to each other and to Ethiopian *poliogastrus,* and so should all now be treated as full endemic species. Northern Kenyan *kulalensis* was recovered close to Ethiopian *poliogastrus*, in a clade sister to *kikuyuensis*, and should be retained *pro tempore* as a subspecies of a restricted *Z. poliogastrus*. Meimberg *et al.* (2016) used DNA data from the entire mitogenome but from a restricted number of Kenyan taxa. Their findings were in agreement with those of Cox *et al.*, except that *sylvanus* emerged as basal to other montane populations. They confirmed that *kulalensis* is closely related to *poliogastrus*. But relationships between *sylvanus, kikuyuensis, kulalensis, poliogastrus* and Ethiopian *kaffensis* still require further research.

The various forms hitherto treated as subspecies of *Z. senegalensis* were recovered by Cox *et al.* (*op. cit.*) and Cox (2013) within two different major African clades. Within a 'northern' clade *senegalensis* and *jacksoni* may still be treated together under a restricted *Z. senegalensis,* but the forms *stierlingi* and *anderssoni* were recovered within a major 'southern' clade, as sister to *Z. virens* of South Africa (see also Oatley *et al.* 2012), and may be treated as subspecies of *Z. anderssoni.* Limited evidence on the east-central African forms (*stuhlmanni, toroensis* and *scotti*) indicates that these comprise a group within the northern clade, but polyphyletic with respect to *senegalensis*. We would therefore place them *pro tempore* within a separate species, *Z. stuhlmanni.* Evidence for placement of the South Sudan form *gerhardi* was conflicting, and requires further research. A specimen from the Imatong Mountains was recovered close to *poliogastrus,* but two more were recovered with *jacksoni.* Although this highland

subspecies is quite distinct from the smaller, paler nominate *senegalensis* of surrounding lowlands (G. Nikolaus, pers. comm.) we prefer to retain it as a subspecies of the northern *senegalensis* clade pending the latter's further resolution.

Within *Z. abyssinicus* (*sensu latu*), the similar yellow-bellied subspecies *flavilateralis* and *jubaensis* were recovered by Cox (2013) in a different major clade from northeast African grey-bellied subspecies (including *omoensis*), and must therefore be treated under a separate species *Z. flavilateralis*. In genetic studies using nuclear microsatellite DNA (Habel *et al*. 2013) the Pemba Island form *vaughan*i was shown to cluster quite separately from *Z. senegalensis*. With its addition as *Z. vaughani* the number of species occurring in Kenya, Uganda and Tanzania is now expanded to eleven. Details of these follow, and include some suggested new English names. The known distributions of highland and lowland taxa are shown in Figs. 1 and 2.

Revised list of East African *Zosterops* species

Order is based largely on the phylogeny of Cox *et al.* (2014). Also see Appendix. 1.

Key to abbreviations

K: Kenya. T: Tanzania. U: Uganda
RB: Breeding Resident. R(B): Resident, but breeding not confirmed
AMNH: American Museum of Natural History; GR: Game Reserve; NP: National Park; MCZ: Museum of Comparative Zoology, Harvard University, USA; NHM: Natural History Museum, Tring, UK; NMNH: National Museum of Natural History, Smithsonian Institute, USA; ZMB: Zoologisches Museum Berlin.

[*Zosterops abyssinicus* Guérin-Méneville 1843 **Abyssinian White-eye**

Nomenclature: Referred to as the White-breasted White-eye in Mackworth-Praed & Grant (1955). Attributed to Kenya and Tanzania by Hall & Moreau (1970) who at the time treated it as conspecific with *flavilateralis*, a course followed by several subsequent authors.

Zosterops abyssinicus omoensis Neumann 1904. Type locality Senti-Tal, a valley between Uba and Gofa, southern Ethiopia.

K Although no records to date, it can be expected to occur in Ethiopian border areas near the southern end of Lake Stephanie.]

Zosterops mbuluensis Sclater & Moreau **Mbulu White-eye**

See Taxonomic comments under the Taita White-eye *Z. silvanus*. Note that the specimens considered in the analyses of Cox *et al.* (2014) were all from the Chyulu Hills.

Monotypic species. **K T RB**. Northern Tanzania highlands from Mt Hanang and the Mbulu Highlands north to Oldeani, the Crater Highlands, Ketumbeine, the North Pares, Longido, Namanga Hill and the Chyulu Hills.

Zosterops virens mbuluensis Sclater & Moreau 1935. *Bulletin of the British Ornithologists' Club* 56: 13. Type locality 2100 m Oldeani Forest, Crater Highlands, Mbulu District, northern Tanzania, 3°16′ S, 35°26′ E. Holotype in NHM, collected for Reg Moreau, 6 September 1934. (Includes *chyuluensis*.)

[*Zosterops chyuluensis* van Someren 1939. *Journal of the East Africa Natural History Society* 14: 114. Type locality 2070 m Chyulu Hills, southern Kenya, *c.* 2°35′ S, 37°50′ E. Holotype NHM, van Someren Collection, ex. Chyulu Hills, 26 June 1938.]

Zosterops flavilateralis Reichenow **Pale Scrub White-eye**

Taxonomic comment: formerly treated as a subspecies of *Z. abyssinicus*.

***Zosterops flavilateralis flavilateralis*. K T RB.** Occurs over much of interior eastern and southern Kenya, and in lowland areas of northern, northeastern and central Tanzania, including much of Masailand, also from the Nairobi suburbs north to Samburu and Laikipia districts, and the central and northern Rift Valley. Birds described as *fricki* from Murang'a District and the Upper Tana north to the Ndotos are smaller and paler, but can hardly be described as intergrades with *jubaensis* (Friedmann 1937). Early specimens from Lotonok, South Turkana, were assigned here, and remain the only records west of the Rift Valley. (Includes *massaicus* and *fricki*.)

Zosterops flavilateralis Reichenow 1892. *Journal für Ornithologie* 40: 193. Type locality East Africa. Later restricted to Ndi, Taita District, southeastern Kenya, 3°14′ S, 38°30′ E. by Sclater (1930). Holotype in ZMB, collected by J.M. Hildebrandt, July 1877.

[*Zosterops massaica* van Someren 1922. *Novitates Zoologicae* 29: 192. Type locality Sagala (south of Voi), Taita District, southeastern Kenya, *c.* 3°30′ S, 38°35′ E. Holotype in AMNH, collected by/for van Someren, 8 August 1918.]

[*Zosterops senegalensis fricki* Mearns 1913. *Smithsonian Miscellaneous Collection* 61 (20): 6. Type locality Bowlder Hill, Thika River, Fort Hall District, central Kenya, approximately 0°56′S, 37°21′E. Holotype in NMNH, collected by Edgar A. Mearns, 28 August 1912.]

Zosterops flavilateralis jubaensis Erlanger 1901. Type locality Damasso & Gurra, Somalia. *Ornithologische Monatsberichte* 9: 182.

K R(B). Mt Kulal and the Horr Valley, and birds in northern and northeastern border areas at Moyale, Mandera and El Wak also belong here. Some specimens from Kenya coastal lowlands south to Lamu, Manda, Witu and Ngomeni, and inland along the Lower Tana River to Baomo are reported to be *fricki* x *jubaensis* intergrades. Records from Wajir and Mombasa are not racially assigned.

Zosterops silvanus Peters & Loveridge **Taita White-eye**

Taxonomic comment: Cox (2013) and Cox *et al.* (2014) found strong support for *silvanus* as an independent evolutionary unit, quite separate from *mbuluensis* and *winifredae*. No hybrids are known between these forms.

Monotypic species. **K RB.** Taita Hills and Mt Kasigau, southeastern Kenya.

Zosterops silvanus Peters & Loveridge 1935. *Proceedings of the Biological Society, Washington* 48: 77. Type locality 1460 m Mt Mbololo, Taita Hills, southeastern Kenya, 3°20′ S, 38°26′ E. Holotype in MCZ, collected by Arthur Loveridge, 21 April 1934.

Zosterops winifredae Sclater & Moreau **South Pare White-eye**

See Taxonomic comments under the Taita White-eye *Z. silvanus*.

Monotypic species. **T RB.** Confined to the South Pare Mts, northeastern Tanzania.
Zosterops winifredae Moreau & Sclater 1934. *Bulletin of the British Ornithologists' Club* 55: 14. Type locality Chome, 1890 m South Pare Mts, Usambara District, northeastern Tanzania, 4°18′ S, 37°53′ E. Holotype in NHM, collected by R.E. Moreau, 9 July 1934.

Zosterops anderssoni Shelley **Southern Yellow White-eye**

Taxonomic comment: formerly treated as a subspecies of *Z. senegalensis*. The lowland (*miombo*) *anderssoni* is typically separate from the largely montane forest *stierlingi*, but Irwin (1981) referred to increasing intergradation between the two in areas of contact in Zimbabwe. There are also marked morphological differences: one pale yellowish-green above and bright yellow below with a narrow eye-ring (*anderssoni*), the other darker green above with a broader eye-ring (*stierlingi*). Here we treat *stierlingi* as a subspecies of *Z. anderssoni*. Meanwhile, molecular evidence in Oatley *et al.* (2012), Habel *et al.* (2013) and Cox *et al.* (2014) suggests that there may be a case for placing both *anderssoni* and *stierlingi* within the southern African *Zosterops virens* group. Further studies of both forms are warranted.

Zosterops anderssoni Shelley 1892. Type locality Ovamboland, northern Namibia. *Bulletin of the British Ornithologists' Club* 1: 5.

Zosterops anderssoni anderssoni **T RB**. Southern and southwestern savannas and woodlands. Birds in *miombo* in the Mpanda–Katavi–Rukwa region appear to belong here, as do others in Ruaha NP, the Selous GR, Songea District, the Rondo Plateau and some southeastern coastal forests, despite reported intergrades with *stierlingi* in several areas. (Includes *niassae*.)

[*Zosterops niassae* Reichenow 1904. *Journal für Ornithologie* 52: 133. Type locality Songea, Ruvuma Region, southern Tanzania, 10°41′ S, 35°39′ E. Type material in ZMB, collected by Dr N. Stierling, 28 July 1900.]

Zosterops anderssoni stierlingi **T RB**. Southern Tanzanian highlands from Mt Rungwe, the Poroto and Livingstone Mts, Matengo Highlands and Songea north to the Iringa Highlands and the Eastern Arc Mountains including the Udzungwas, Rubehos, Ulugurus, Ukagurus, Ngurus and the Usambaras. [Birds at Mahale Mountains NP (not satisfactorily assigned) require evaluation.]

Zosterops stierlingi Reichenow 1899. *Journal für Ornithologie* 47: 418. Type locality Iringa, Uhehe country, southern Tanzania, 7°47′ S, 35°42′ E. Type material in ZMB, collected by Dr N. Stierling, 1 May 1897. (Includes *sarmenticius* and *usambarae*.)

[*Zosterops virens sarmenticia* Bangs & Loveridge 1931. *Proceedings of the New England Zoological Club* 12: 95. Type locality Igale, Poroto Mts, southern Tanzania, 9°05′ S, 33°26′ E. Holotype in MCZ, collected by Arthur Loveridge, 25 April 1930.]

[*Zosterops usambarae* Reichenow 1909. *Ornithologische Monatsberichte* 17: 42. Type locality Mlalo, near Wilhelmstal, West Usambaras, northeastern Tanzania, 4°34′ S, 38°19′ E. Type material in ZMB, collected by Pastor K. Roehl.]

Zosterops vaughani Bannerman **Pemba White-eye**

Taxonomic comment: Formerly treated by many authors as a subspecies of *Z. senegalensis* despite differing vocalizations, but proves to be genetically distinct (Habel *et al.* 2013). A molecular comparison is needed *with stierlingi* and *anderssoni*.
Monotypic species. **T RB**. Common throughout Pemba Island including off-shore islets.

Zosterops vaughani Bannerman 1924. *Bulletin of the British Ornithologists' Club* 44: 41. Type locality Pemba Island, Tanzania, approximately 5°10′ S, 39°50′ E. Holotype in NHM, collected by J. H. Vaughan, September 1923.

Zosterops eurycricotus Fischer & Reichenow **Tanzania Broad-ringed White-eye**

Monotypic species. **T RB.** Mts Meru and Kilimanjaro, Arusha NP and at Mts Essimingor, Lossogonoi and Lolkissale.

Zosterops eurycricotus Fischer & Reichenow 1884. *Journal für Ornithologie* 32: 55. Type locality base of Mt Meru (= Arusha NP), northern Tanzania, *c.* 3°14′ S, 36°45′ E. Holotype in Hamburg Museum, collected by G. Fischer, 17 July 1883. (Includes *perspicillatus* and *meruensis*.)

[*Zosterops perspicillata* Shelley 1889. *Proceedings of the Zoological Society* p. 366. Type locality 1520 m on Mt Kilimanjaro (east side), northern Tanzania, *c.* 3°04′ S, 37°35′ E. Syntypes (2) in NHM, collected by H.C.V. Hunter, 11 August 1888.

[*Zosterops virens meruensis* Sclater & Moreau 1935. *Bulletin of the British Ornithologists' Club* 56: 14. Type locality 1830 m Nguru Narok Forest, Mt Meru, northern Tanzania, 3°14′ S, 36°45′ E. Holotype in NHM, collected by/for R.E. Moreau, 26 January 1935.]

Zosterops stuhlmanni Reichenow **Green White-eye**

Taxonomic comment: Cox (2013) found that *stuhlmanni, toroensis* and *reichenowi* were recovered as a distinct evolutionary lineage, which we treat as *Z. stuhlmanni*. Included are birds which have been known as *Z. virens stuhlmanni* or *Z. senegalensis stuhlmanni*. Placement of the Albertine Rift montane form *scotti* remains tentative.

***Zosterops stuhlmanni stuhlmanni* T U RB.** Ngara, Biharamulo, Mwanza and Bukoba Districts of northwestern Tanzania north to western and southern Uganda below 1700 m, including most Lake Victoria off-shore islands. **K.** Intergrades with *Z. senegalensis jacksoni* reported from Nyanza and Kakamega districts.

Zosterops stuhlmanni Reichenow 1892. *Journal für Ornithologie* 40: 54. Type localities Bukoba (1°19′ S, 31°49′ E) and Sesse Islands (0°20′ S, 32°20′ E), Lake Victoria. Syntypes ZMB, collected by Emin (Bukoba) November 1890, and F. Stuhlmann (Sesse Islands), December 1890.

Zosterops stuhlmanni toroensis Reichenow 1904. *Journal für Ornithologie* 52: 133. Type locality Kitamba, Semliki, DR Congo.

U R(B). Lowland areas of western and southwestern Uganda, notably the Bwamba lowlands and Semliki NP.

***Zosterops stuhlmanni scotti* U RB**. 1850–3000 m in the Rwenzoris, also in the Bwindi-Impenetrable NP and above 3000 m in the Virunga Volcanos.

Zosterops scotti Neumann 1899. *Ornithologische Monatsberichte* 7: 24. Type locality 2440 m Yerua (= Yeriya Forest), east Rwenzori Mts, western Uganda, 0°31′ N, 30°06′ E. Holotype in NHM, collected by G.F. Scott-Elliott (mid-1890s).

Zosterops kikuyuensis Sharpe **Kikuyu White-eye**

Monotypic species. **K RB**. Central Kenya highlands from Meru and Embu Districts, Mt Kenya, and the Aberdares south to Nairobi.

Zosterops kikuyuensis Sharpe 1891. *Ibis* (6) 3: 444. Type locality Kikuyu forest, central Kenya, *c.* 1°00′ S, 36°40′ E. Holotype in NHM, collected by Sir F. Jackson, 15 August 1889. (Includes *somereni*.)

[*Zosterops virens somereni* Hartert 1928. *Novitates Zoologicae* 34: 207. Type locality Mt Kenya, above Chuka, Embu District, 0°20′ S, 37°39′ E. Holotype AMNH, collected by Noel van Someren, 15 January 1921.]

Zosterops poliogastrus Heuglin **Heuglin's Montane White-eye**

Taxonomic comment: Cox (2013) found that most of the former *Z. poliogastrus* subspecies formed independent clades polyphyletic with respect to each other. But *kulalensis* proved to be associated with Ethiopian montane forms, and is retained here within *Z. poliogastrus*. It was genetically close to *kikuyuensis* but more distant from the southern forms *mbuluensis*, *sylvanus* and *winifredae*.

Zosterops poliogastra Heuglin 1861. Type locality northern Ethiopia. Species name change from *poliogastra* to *poliogastrus* follows David & Gosselin (2002).

***Zosterops poliogastrus kulalensis*. K RB.** Confined to Mt Kulal, northern Kenya, where it seasonally favours areas of evergreen bush as well as forest.

Zosterops pallida kulalensis Williams 1948. *Bulletin of the British Ornithologists' Club* 68: 101. Type locality Mt Kulal, northern Kenya, 2°43′ N, 36°56′ E. Holotype in NHM, collected by John G. Williams, 8 October 1947.

Zosterops senegalensis Bonaparte **Northern Yellow White-eye**

Taxonomic comment: Cox (2013) found that with the exception of *jacksoni* (Kenya highlands), all former East African *senegalensis* subspecies were recovered in clades independent from the nominate form.

Zosterops senegalensis Bonaparte 1850. Type locality Senegal.

***Zosterops senegalensis senegalensis* U RB**. Northern Uganda south to lakes Albert and Kyoga. Savanna birds at Kidepo NP and elsewhere in Karamoja District may also belong here. (Includes *superciliosus*.)

[*Zosterops superciliosa* Reichenow 1892. *Journal für Ornithologie* 40: 193. [See also Chapin 1954: 180.] Type locality "Wadelai" but specimens came from Kiri (South Sudan) and Fadjulle (= Pajule, Acholi country, northern Uganda), 2°58′N, 32°57′E. Syntype from Pajule in AMNH, collected by Emin Pasha, 1881.]

***Zosterops senegalensis jacksoni* K RB**. 1525–3050 m in the northern and western Kenya highlands from the Loima Hills, Mt Elgon, Cheranganis, southern Kerio Valley, Tugen Hills, Ndotos, Mathews Range and Mt Marsabit south to Laikipia, Mt Garguess and the lower slopes of Mt Kenya. In the west it occurs in Kakamega and Nandi districts, also the Gwassi Hills, and from Trans-Mara, Lolgorien and Mara GR east to the Loitas and the Ngurumans, the Mau, Gilgil, Naivasha and some western Nairobi suburbs. Meanwhile, birds in some western border areas appear to be intergrades with *stuhlmanni*. **T RB.** Known only from the Loliondo area of the northern Serengeti. Birds of the Mara Region and on Ukwerere Island (not racially assigned here) may be closer to *Z. stuhlmanni*. **U RB**. Birds in the south Elgon foothills around Mbale and Tororo appear to belong here, as do birds that reach 3400 m on the Mt Elgon moorlands. [A specimen collected from mist-forest at 2600 m on Mt Moroto (May 1963), and treated at the time as *Z. senegalensis flavilateralis* requires re-evaluation.]

Zosterops jacksoni Neumann 1899. *Ornithologische Monatsberichte* 7: 23. Type localities: the Mau, Guasso Massai, Nandi country and Mt Elgon. Syntypes ZMB, collected by

Neumann (November 1894) and Jackson (February 1890). (Includes *garguensis*, *bayeri*, *elgonensis* and *yalensis*.)

[*Zosterops virens garguensis* Mearns 1913. *Smithsonian Miscellaneous Collections* 61 (20): 7. Type locality 2165 m Mt Gargues (Uraguess), northern Kenya, 0°56′ N, 37°24′ E. Holotype in NMNH, collected by Edmund Heller, 25 August 1911.]

[*Zosterops bayeri* Lönnberg 1917. *Arkiv för zoologi* 11(5): 3. Type locality Londiani Forest, central Kenya, *c.* 0°10′ S, 35°36′ E. Holotype in RMCA, Tervuren, collected by Dr Leo Bayer, 29 March 1914.]

[*Zosterops elgonensis* van Someren 1922. *Novitates Zoologicae* 29: 191. Type locality Bukedi (= Bugwere), near Mbale, western side of Mt Elgon, eastern Uganda, *c.* 1°00′ N, 34°00′ E. Holotype in AMNH, collected by/for van Someren, 13 January 1916.]

[*Zosterops yalensis* van Someren 1922. *Novitates Zoologicae* 29: 191. Type locality Kaimosi, Kakamega District, western Kenya, 0°11′ N, 34°47′ E. Lectotype in AMNH, collected by Allen Turner (pp. Col. R Meinertzhagen) 22 January 1917.]

Zosterops senegalensis gerhardi van den Elzen & Koenig 1983. *Bonner Zoologische Beiträge* 34: 164. Type locality Imatong Mts, South Sudan.

U. Mt Lonyili, Kidepo Valley NP, northeastern Uganda.

Discussion

In mainland East Africa, the treatment of some 16 recognized taxa within three white-eye species (Hall & Moreau 1970, Zimmerman *et al.* 1996, Fry 2000) has long seemed unsatisfactory. Species limits have partly been based on phenotypic characters such as the intensity of yellows and greens in the plumage and width of the eye-ring, yet grey-bellied forms have been lumped as sub-species with yellow-bellied ones. Habitat and altitude preferences have also been considered important in defining species. Thus, the grouping of the isolated eastern montane populations under a single species *Z. poliogastus* has assumed that all were derived from a forest ancestor which diverged into distinctive populations following retreat into isolated highland refugia during cool and arid climatic periods of the Plio-Pleistocene (Hall & Moreau *op. cit.*, Diamond & Hamilton 2009). The continued placement of other highland taxa such as *jacksoni, stierlingi* and *scotti* with lowland *Z senegalensis* has therefore seemed far from logical.

Molecular genetics, which provided answers concerning the evolution of white-eyes in the western Indian Ocean (Warren *et al.* 2006) and the Gulf of Guinea (Melo *et al*. 2011), is now revealing relationships among mainland African forms, especially in East Africa. The traditional taxonomy no longer proves acceptable. Thus, most of the eastern 'sky island' forms have been found to represent independent species; the morphologically very similar forms inhabiting lowlands in southern Tanzania and northern Uganda have been recovered in quite separate lineages; and the paler yellow birds of the drier eastern Kenyan and northeast Tanzanian lowlands prove not to be allied to grey-bellied Ethiopian forms. In East Africa we must thus recognize at least five additional highland species, *Z. sylvanus, Z. winifredae, Z. kikuyuensis, Z. eurycricotus* and *Z. mbuluensis,* and at least one new lowland species *Z. anderssoni* (and preferably a second, *Z. stuhlmanni*), while our former Abyssinian White-eye becomes *Z. flavilateralis.*

Our understanding of the distribution of some white-eye taxa in East Africa has been obscured by difficulties of separation and correct identification in the field. Specimens are lacking from some areas where forms potentially come into contact or overlap. Thus the range of *anderssoni* in Tanzanian lowlands, and the extent of its contact, if any, with *stuhlmanni* and *flavilateralis*, remain to be clarified. The absence of white-eyes from wide areas of arid northern and eastern Kenya needs to be confirmed. And the limits of *senegalensis* and *toroensis* in Uganda require further definition. The restricted ranges of the highland taxa are better known, but questions remain regarding birds that occupy the Mahali and Gombe Stream National Parks in western Tanzania, and highlands near the northeast Uganda/northwest Kenya border. Good photographs from some of these lesser explored areas are likely to be essential to answer pending questions.

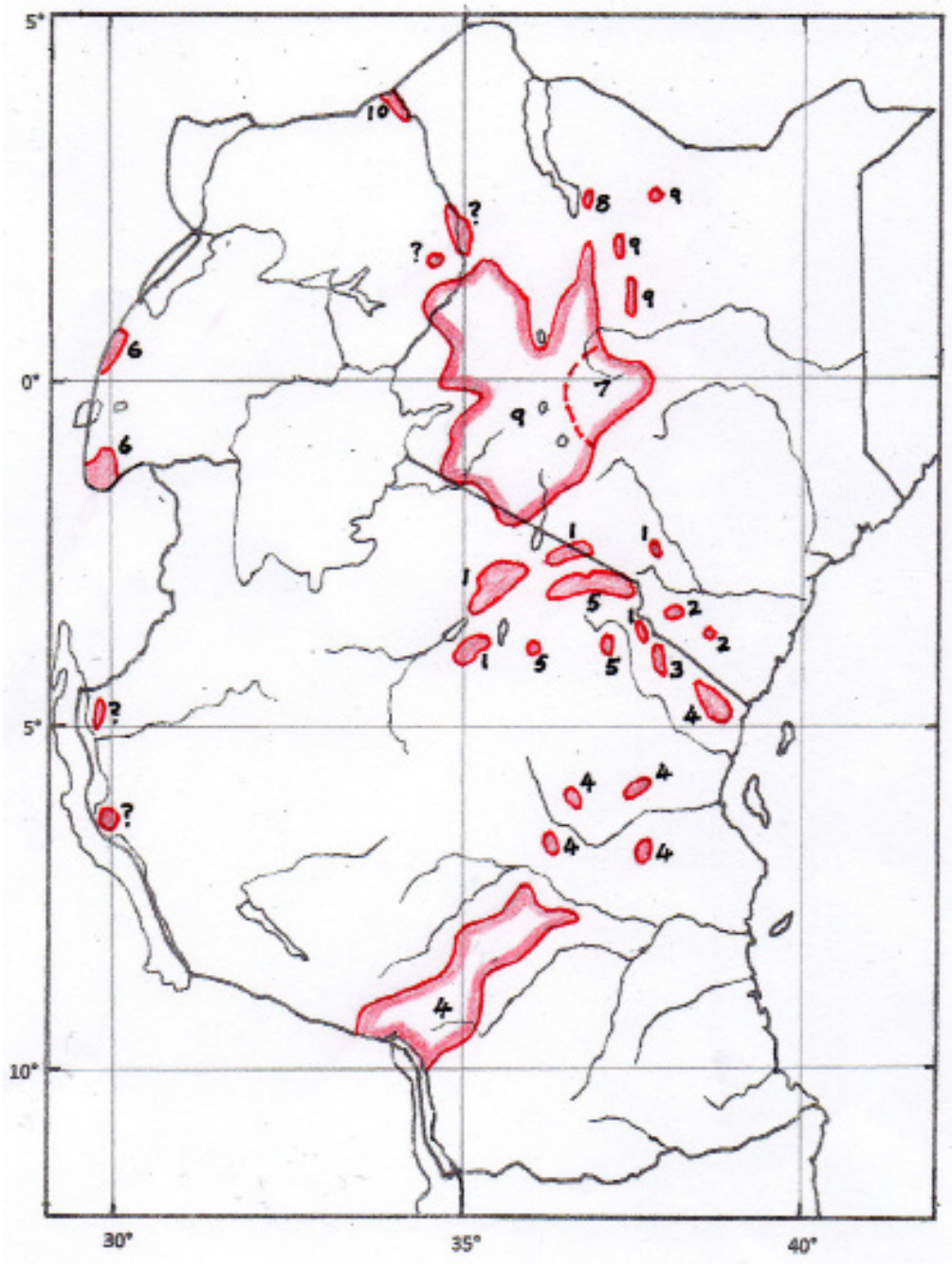

Figure 1. East African distribution of highland taxa: 1–*mbuluensis*, 2–*sylvanus*, 3–*winifredae*, 4–*stierlingi*, 5–*eurycricotus*, 6–*scotti*, 7–*kikuyuensis*, 8–*kulalensis*, 9–*jacksoni*, 10–*gerhardi*, ?–taxon undetermined.

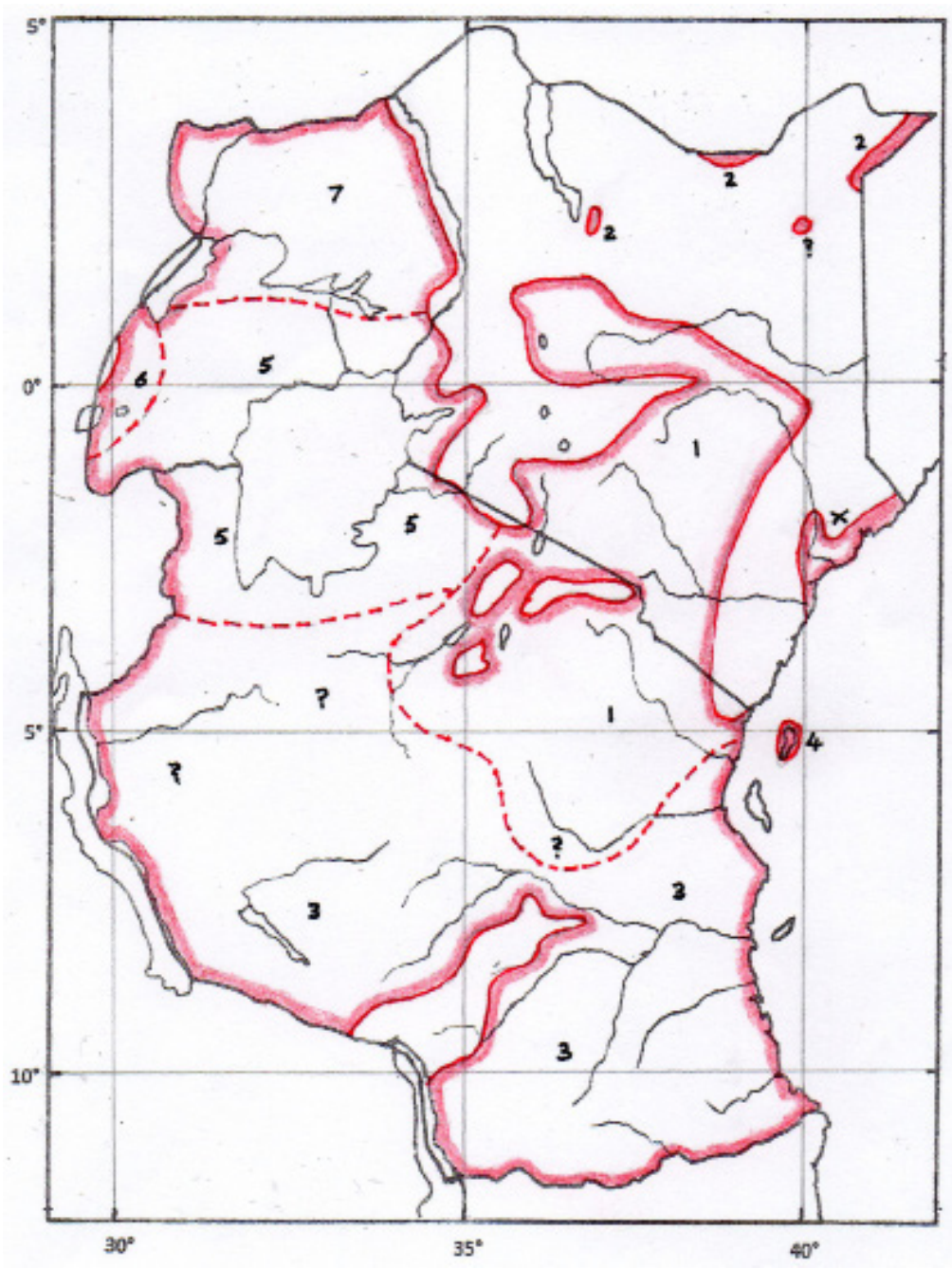

Figure 2. East African distribution of lowland taxa: 1–*flavilateralis*, 2–*jubaensis*, 3–*anderssoni*, 4–*vaughani*, 5–*stuhlmanni*, 6–*toroensis*, 7–*senegalensis*, x–reportedly *flavilateralis*/*jubaensis* intergrades, ?–undetermined.

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Appendix 1. East African *Zosterops* taxa

	Endemic	Kenya	Tanzania	Uganda
Zosterops mbuluensis	x	x	x	
Zosterops flavilateralis				
Z. f. flavilateralis	x	x	x	
Z. f. jubaensis		x		
Zosterops silvanus	x	x		
Zosterops winifredae	x		x	
Zosterops anderssoni				
Z. a. anderssoni			x	
Z. a. stierlingi			x	
Zosterops vaughani	x		x	
Zosterops eurycricotus	x		x	
Zosterops stuhlmanni				
Z. s. stuhlmanni			x	x
Z. s. foroensis				x
Z. s. scotti				x
Zosterops kikuyuensis	x	x		
Zosterops poliogastrus				
Z. p. kulalensis	x	x		
Zosterops senegalensis				
Z. s. senegalensis				x
Z. s. jacksoni	x	x	x	x
Z. s. gerhardi				x
Number of taxa	9	7	9	6