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Vocalisations, taxonomy and nomenclature of the pied boubous of eastern Africa

by James E. Bradley

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Summary.—A vocal analysis of the duets of pied boubous *Laniarius* spp. across eastern Africa is presented, focusing on birds from coastal Somalia south to Mozambique. Based on the presence or absence of certain note types in duets, and variation in their structure across different populations in this region, forms of duet were found to cluster at both larger and smaller spatial scales. Vocal congruence suggests that taxon *mossambicus* could be conspecific with *sublacteus*, whereas marked differences between these two and coastal Kenyan birds confirm their previously reported genetic distinctiveness. Patterns of vocal variation broadly align with taxonomic divisions already indicated by genetic data and I integrate these to identify and define the ranges of four distinct groups: the Tropical (*major* and *ambiguus*), Ethiopian (*aethiopicus*), Somali (*somaliensis*) and East Coast groups (*sublacteus*, *mossambicus* and extralimital *limpopoensis*). Species rank for birds in coastal Kenya under the name Juba Boubou *L. somaliensis* is also proposed, and vocal data presented here support the findings of Nguembock *et al*. (2008) and Finch *et al*. (2016) that plumage criteria are unreliable indicators of taxonomy in *Laniarius*.

Following the taxonomy of Gill *et al*. (2021), and distributions reported by Fry *et al*. (2000), the pied boubous in eastern Africa are currently thought to comprise three species. The monotypic Ethiopian Boubou *Laniarius aethiopicus* (J. F. Gmelin, 1789) occurs in far eastern South Sudan north to Eritrea and east through Ethiopia to northwest Somalia and northern Kenya at Moyale.

Tropical Boubou *Laniarius major* (Hartlaub, 1848) is represented by three subspecies in the region covered here. *L. m. major* occurs in West and Central Africa east to South Sudan, Uganda, central and western Kenya, north-central Tanzania (Essimingor, Loliondo and Ngorongoro) south to Njombe, extreme north Malawi (where it intergrades with *L. m. mossambicus*) and west to north and north-west Zambia; *L. m. ambiguus* von Madarász, 1904, east of the Rift Valley in northern Tanzania (Mt. Kilimanjaro and Mt. Meru) and Kenya, north to Marsabit and Mt. Kulal; and *L. m. mossambicus* (Fischer & Reichenow, 1880) Zambia (except the north and north-west), Malawi (except the far north), eastern Botswana, Zimbabwe (except the far south-east) and Mozambique.

Finally, the monotypic East Coast Boubou *Laniarius sublacteus* (Cassin, 1851) is found in the lowlands of extreme southern coastal Somalia through coastal Kenya to north-east Tanzania (including the Usambara and North Pare Mountains) to Zanzibar.

However, the genus *Laniarius*, including the taxa mentioned above, has long confounded taxonomists and field workers (Harris & Franklin 2000), and it is only comparatively recently that genetic analyses have shed light on some of the less well understood relationships (Nguembock *et al*. 2008, Finch *et al*. 2016). A key finding has been that intraspecific polymorphism occurs in the genus, making some plumage traits unreliable indicators of genetic affinity and species-level taxonomy. Specifically, Nguembock *et al*. (2008) concluded that divergence may have taken similar form in separate lineages,

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resulting in distantly related taxa showing convergent morphology. While resolving some uncertainties, molecular studies also identified issues in need of further study, one of these being the taxonomy of pied boubous in the coastal forests of East Africa. Birds in this region were all considered as *L. sublacteus* (see above) until Nguembock *et al*. (2008) showed that, in fact, two visually identical species were involved: birds from the East Usambara and Rubeho Mountains of north-east Tanzania were referred to *sublacteus* Cassin, 1851 (type locality Eastern Africa?; see Discussion), and found to be possibly allied to extralimital Southern Boubou *L. ferrugineus* (J. F. Gmelin, 1788); and those in the Sokoke Forest, coastal Kenya, were found to be most closely related to *L. major*, and perhaps distantly allied to Turati's Boubou *L. turatii* (J. Verreaux, 1858: type locality Guinea-Bissau; see Bannerman 1939) from West Africa.

Due, however, to concern that the sample from Sokoke may have been contaminated, Nguembock *et al*. (2008) left this apparently distinct population unnamed. Subsequently, however, Finch *et al*. (2016) demonstrated that this population is genetically distinct from north Tanzanian birds, and instead was a close relative of a pied boubou from southern coastal Somalia named *somaliensis* Reichenow, 1905. Whilst *somaliensis* differs in appearance from closely related birds of coastal Kenya only by having white vs. black 'shoulders', it has incorrectly been regarded as a pied morph of the all-black Coastal Boubou *L. nigerrimus* (Reichenow, 1879) (= *L. erlangeri*; see Ash & Miskell 1998) with which it is sympatric in south-coastal Somalia. However, due to uncertainty over whether the type of *sublacteus* may be from the Sokoke Forest region, or from the Usambaras in north-east Tanzania, Finch *et al*. (2016) also declined to assign a name to birds in coastal Kenya. Therefore, while the pied boubou of coastal Kenya is specifically distinct from identical-looking birds in coastal Tanzania, it still bears the same name, *sublacteus*. Meanwhile birds from south-coastal Somalia (*somaliensis*), from the same genetic lineage as those in coastal Kenya, are currently not afforded recognition in any world checklist (Dickinson & Christidis 2014, del Hoyo & Collar 2016, Clements *et al*. 2019, Gill *et al*. 2021).

Meanwhile, the vocalisations of the pied boubou complex have yet to be studied in light of the genetic findings. The well-known duets in *Laniarius* spp. are typically loud and distinctive, involving repeated simple motifs, with each sex's contribution highly synchronised (Fry *et al*. 2000, Harris & Franklin 2000). Duet parts of each sex may be overlapping or antiphonal, and serve to defend a territory. Consistent duetting patterns across all groups involve either: (a) lower or higher bell-like notes from males, and a snarl-like note (hereafter snarl), by females, or (b) slow, monotone whistles and croaking notes by males with snarls by females (pers. obs.). Across the wide geographical area covered here, these duets are sufficiently variable that regional patterns may be detected that provide further insight into pied boubou taxonomy, especially where polymorphism may obscure cryptic diversity. In assigning birds to vocal groups based on their duets, I seek to reconcile these with genetic data and published distributions, to better define the range limits of taxon groupings. Given persisting disagreement, I also suggest a possible revised nomenclature and taxonomy for the group.

Methods

Recordings of pied boubou vocalisations were sourced via correspondence with observers and online at Xeno-canto (www.xeno-canto.org), Macaulay Library (www.macaulaylibrary.org) and AVoCet (www.avocet.zoology.msu.edu). Additional recordings at the British Library but not available online were not consulted. Recordings were analysed from across all of East Africa, but with a focus on coastal southern Somalia south to Malawi and northern Mozambique. Vocalisations of some extralimital taxa were also analysed,

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for context. The vocalisations of duetting pairs formed the principal basis of the analysis, to recognise distinct vocal groups and, if possible, allocate taxa to them. While each sex mimics the voice of the other, and is therefore capable of producing duet phrases in solo renditions, there appears to be no evidence suggesting that the sexes reverse their roles during actual duets, and the attribution of sexual identity throughout this paper is inferred based on extensive review of audio recordings, video footage and personal field experience over a period of 30 years in Kenya and Tanzania. In describing repertoires of each group, only the main songs and calls are considered, these being heard 75% or more of the time in the field (pers. obs.). Examples are presented as sonograms, created using Syrinx software (Burt 2006). For my analyses, birds at Sokoke Forest, Kenya are treated as *L. somaliensis*, in line with genetic and morphometric congruence (Finch *et al*. 2016).

Results

Three hundred and sixty-five audio recordings of pied boubou taxa were analysed. Duets recorded from across East Africa were grouped based on various shared characteristics and the presence or absence of certain notes in different populations. For example, snarls comprise the only duet vocalisations by females in some populations while, among the more variable notes delivered by males, some are also specific to certain groups (Table 1). The analysis of vocalisations using these criteria suggests the presence of four main vocal groups in East Africa, with one split into two subgroups (Fig. 6), and a fifth group comprising intergrades, as detailed below. Following each group name, the data in parentheses note the taxa assigned to it and the number of recordings of my overall sample that pertain to each group.

Tropical group (*major* and *ambiguus*; *n* = 170 [northern subgroup], *n* = 39 [southern subgroup]; see Figs. 6–7). *Distribution*.—Recordings from West Africa (Cameroon, Ghana, Ivory Coast), east to Nyankunde, DR Congo, to Uganda and Kenya (Murchison Falls, Mt. Elgon, Tugen Hills, Mt. Kenya, the Aberdares, Nairobi, Chyulu Hills) south through northern and western Tanzania and the Albertine Rift (Kilimanjaro, Arusha, Iringa and Mufindi, Sitebe, Kigoma, Minziro Forest, Kigali, Bujumbura, Goma) to northern Zambia (Kitwe, Mayau, Salujinga) and southern DR Congo (Lubumbashi).

Basic duet.—Two bell-like notes on different pitches; the female initiates with a high note, followed by a shorter and lower note by the male, which typically overlaps with the end of the female note, e.g. *tee-loo*, repeated (Fig. 1a). These form the basis for more excited duets involving multiple notes by each bird (and which may also be initiated by the male?), usually at a faster pace but always on different pitches, e.g. *loo-tee-loo-tee-loo* or *too-too-too-too-lee*.

Variations.—During aggressive territorial displays, the length of the bell-like notes shortens and speed of delivery increases, resulting in duets of multiple *too-too-too* note series without higher notes (Fig. 1b). During particularly aggressive duets the female may also switch to using a snarl, to accompany the bell-like notes of the male, e.g. *too-grrrr-too* or *too-too-too-grrrr*, with the snarl typically delivered at the same time as the male's notes. However, this is not common, with most duets comprising solely bell-like notes. Bell-like notes in duets may be repeated singly or as multiples and, while male and female sometimes overlap, duets are usually antiphonal.

Unique notes.—Multiple *too-too-too-too* notes delivered during aggressive displays are absent in other groups. In these displays, multiple pairs (up to four; pers. obs.) may engage in a lazy but coordinated routine of bounding from branch to branch on a circular track through the subcanopy of a large tree, while snarls are layered over the multiple bell-like phrases.

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TABLE 1

Attributes of duet phrases by pied boubous *Laniarius* spp. in East Africa. Presence or absence of distinguishing characters in duet vocalisations are highlighted. The Tropical group is divided into northern and southern subgroups, with differences between them shown in Fig. 1. * = examples from Zanzibar, where the drawn out flute-like whistle is also used; ** = examples from the Zambezi and Luangwa Valleys, where the croak note and drawn-out flute-like whistle are also used; green = main differences in duet characteristics between the East Coast and other groups; yellow = duet characteristics unique to both the Somali group and southern Tropical subgroup; orange = duet characteristics common to both the Ethiopian and East Coast groups; blue = possible absence of a female snarl in the repertoire of the Somali group. Attribution of sexual identity is inferred based on extensive review of audio recordings, video footage and personal field experience in Kenya and Tanzania.

			Tropical group		**Ethiopian group**	**Somali group**	**East Coast group**	
Sex	Duet note characteristics	(northern) *major*	(southern) *major*	*ambiguus*	*aethiopicus*	*somaliensis*	*sublacteus*	*mossambicus*
Male	bell-like *too* notes or *too-too-too* series	0.8–1.1 KHz	0.8–1.0 KHz	0.9–1.1 KHz	0.9–1.1 KHz	1.0–1.1 KHz	absent	absent
	sonar-like *too-too-too* series	absent	absent	absent	absent	absent	0.9–1.0 KHz*	0.9–1.0 KHz**
	drawn out flute-like whistle	absent	absent	absent	absent	absent	1.4–2.1 KHz	1.7–2.4 KHz
	varying-pitch note	absent	yes	absent	absent	yes	absent	absent
	frog-like croak note	absent	absent	absent	absent	absent	1.0–1.1 KHz	1.0–1.1 KHz
Female	bell-like *too* notes or *too-too-too* series	yes	yes	yes	yes	yes	absent	absent
	varying-pitch note	absent	yes	absent	absent	yes	absent	absent
	use of basic snarl note	uncommon	uncommon	uncommon	common	absent?	common	common
	embellished (including doubled) snarl notes	absent	absent	absent	yes	absent	yes	yes

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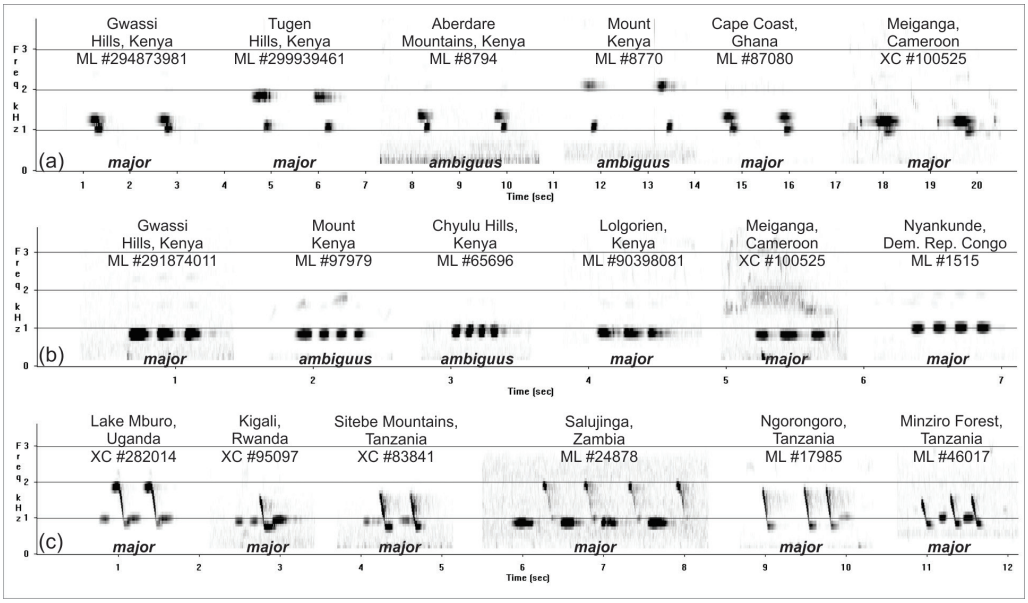


Figure 1. Sonograms of the Tropical group showing (a) variation in the basic *tee-loo* high-low duet (one motif repeated once), (b) rapid, multiple bell-note *too-too-too* calls of Tropical Boubou *Laniarius major* and *L. m. ambiguus* from West Africa to Kenya (single bird), and (c) varying-pitch notes with gonolek-like quality in duets of *L. major* from south-west Uganda, Zambia, and the Mufindi and Ngorongoro regions of Tanzania. For recording credits see Appendix.

Subgroups.—The Tropical group divides into two subgroups, northern and southern, based on differences in duet structure (Fig. 1) Thus, duets by *L. major* populations from the southern fringes of the Congo Basin, north to the Albertine Rift and east to the Crater Highlands of Tanzania differ from those of *L. major* (and *ambiguus*) elsewhere by the inclusion of a varying-pitch note by either the male (Fig. 1c, examples 2, 3, 5 and 6 from left to right) or female (Fig. 1c, examples 1 and 4) in tandem with bell-like notes by the other sex. This varying-pitch note (which is most similar to that used by the Gabela Bushshrike *L. amboimensis* of western Angola) affords a 'plonking' quality to duet phrases, a characteristic perhaps best known among the gonoleks, e.g. *too-k'Yonk-too-k'Yonk-too*. Emphasis is on the low element of this note in the male, and on the high element in the female (like the Somali group).

General comments.—Almost all duets comprise bell-like notes with snarls, by the female, perhaps incorporated into *c*.20–30% of duets on average. Birds in this group make rich, mellow and reverberating notes characteristic of the evergreen forests of interior East Africa.

Ethiopian group (*aethiopicus*; *n* = 32). *Distribution*.—Recordings from throughout the Ethiopian highlands south to Mt. Marsabit, Kenya; see Figs. 6–7).

Basic duet.—Bell-like note duets are very similar to those of the previous group, but the male (low note) may initiate the duet more frequently than in the Tropical group, wherein the female (high note) typically starts the duet (Fig. 2a). Additionally, duets are repeated largely unvaryingly for extended periods, which is not typical of the Tropical group.

Variations.—Unlike the Tropical group, snarls are much commoner elements in duets, and possibly the most frequent female vocalisation. These are usually delivered over the single or multiple, rich bell-like notes of the male.

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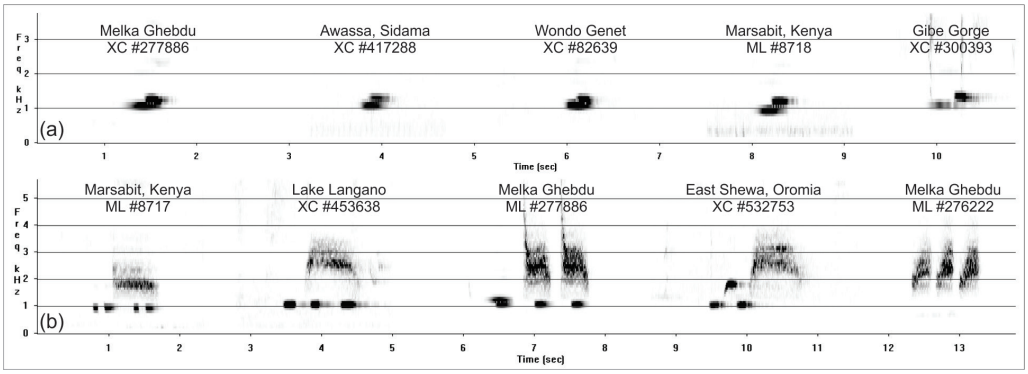


Figure 2. Sonograms of the Ethiopian group showing (a) variation in the basic male-initiated *too-lee* low-high duet, and (b) various snarl notes incorporated into duets or delivered alone by females in the repertoire of Ethiopian Boubou *Laniarius aethiopicus*. Recordings are all from Ethiopia unless labelled otherwise. For recording credits see Appendix.

Unique notes.—Snarls by the female (?) are elaborate in this group, sometimes embellished or doubled over the bell-like notes of the male, or delivered in multiple series by the male alone (Fig 2b). This range of snarls, their frequency of use and combinations in which they are delivered is matched only by subspecies *mossambicus* (see below).

East Coast group (*sublacteus* and *mossambicus*; *n* = 95). *Distribution*.—Recordings from north-east Tanzania (Zanzibar, Saadani National Park, the Usambara and Pare Mountains to Mikumi National Park) south through eastern Tanzania to Mozambique, all of Malawi and Zimbabwe (north of *c*.20°S), eastern and southern Zambia (Luangwa Valley, Kasanka National Park, Lusaka and Zambezi Valley) to north-east Botswana and north-east Namibia (Caprivi); see Figs. 6–7.

Basic duet.—Three unmusical and typically non-overlapping notes (vs. two in other groups) that differ distinctly from those used by all other groups. The typical note of the male, which initiates the duet, is either a distinctive frog-like croak (Fig. 3a) similar to those of Lühder's Bushshrike *L. luehderi* and Braun's (Orange-breasted) Bushshrike *L. brauni*, or a slowly repeated, drawn-out flute-like whistle (Fig. 3b), with a similar piping quality to the song of Grey-headed Bushshrike *Malaconotus blanchoti*, and higher pitched than any typical duet note by males in other groups. When incorporated into duets, croaks or whistles are delivered in a double series with female snarls interspersed, e.g. *peeeeeuu-grrrr-peeeeeuu*.

Variations.—A less common variation involves two snarls by the female between the two notes of the male. Also, a distinctive and slowly delivered series of sonar-like *too-too-too* notes with a tinkerbird-like resonance (very similar to Southern Boubou), followed by a snarl from a female. This is infrequently recorded (examples from Zanzibar and the Luangwa Valley). While structurally not dissimilar to some duets in the Tropical group, the sound in the latter variation is entirely different in quality.

Unique notes.—The croak note of the male does not occur in other groups, whilst a commonly used, exaggerated double snarl by the female is shared only with *aethiopicus*. Meanwhile, *mossambicus* (examples from Malawi, Mozambique and Zambia) may engage in a rapidly repeated duet, including a single sonar note or short, inflected whistle (male) and harsh, grating scold (female), e.g. *too-kaa-too-kaa-too-kaa* or *twee-kaa-twee-kaa-twee-kaa*, which is unique.

General comments.—The female is capable of making only groaning snarls in duets and there are no duets, with each sex whistling on a different pitch, unlike in other groups.

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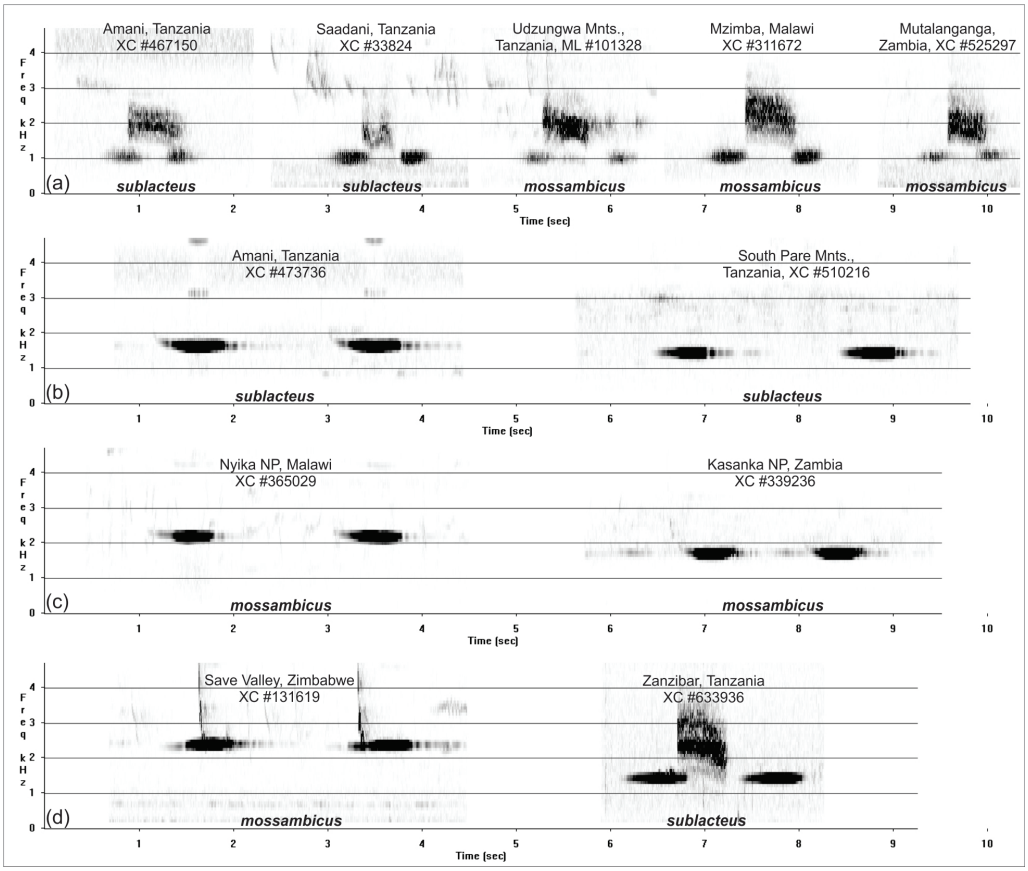


Figure 3. Sonograms of the East Coast group showing (a) variation in the basic croak-snarl-croak duet, and (b–d) the repeated, drawn-out double-monotone whistle that can also be incorporated into a duet (d; Zanzibar) by the addition of a female snarl in the repertoire of East Coast Boubou *Laniarius sublacteus* and *L. m. mossambicus*. For recording credits see Appendix.

Duets also differ, in particular from *major* (and *ambiguus*), in the near-complete absence of *too-too-too* notes in the male's repertoire, of which the rarely heard sonar-like versions described above are the only examples.

Somali group (*somaliensis*; *n* = 30). *Distribution*.—Recordings from the Kenya coast (Lamu, Witu Forest, Sokoke Forest, Samburu [Taru], Rabai, Mombasa, Ukunda, Msambweni, Shimba Hills, Shimoni); see Figs. 6–7.

Basic duet.—Typically comprises two bell-like notes, and initiated by the female with a unique varying-pitch note, sliding from high to low, to match the low note of the male, e.g. *teeyoo-too* (Fig. 4a). This duet is also commonly given in a three-note series initiated with the low note of the male, e.g *too-teeyoo-too* (Fig. 4b).

Variations.—Females may also deliver the varying-pitch note in a double series, followed by a single low note by the male, e.g. *teeyoo-teeyoo-too*, while a less common variation comprises a high-pitched whistle by the female (*c.*2.1 kHz) with an intervening varying-pitch note by the male, e.g. *tee-teeyoo-tee*.

Unique notes.—The varying-pitch note of the female is very distinctive, rendering the duet unique. Also unusual is the apparent absence of a snarl in the female repertoire.

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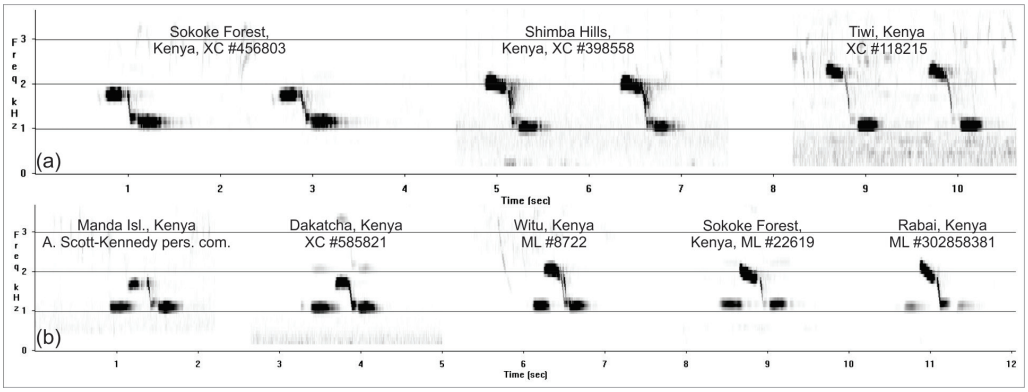


Figure 4. Sonograms of the Somali group showing (a) variation in the basic, yet highly distinctive, two bell-note, female-initiated duet of Juba Boubou *Laniarius somaliensis* from the Kenya coast (single motif repeated once) and (b) the three-note male-initiated version. For recording credits see Appendix.

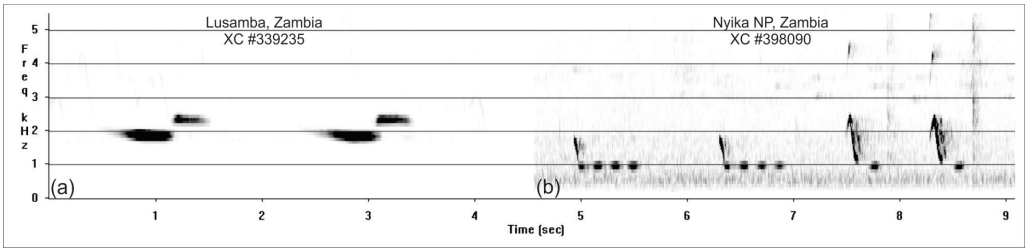


Figure 5. Sonograms of pied boubous *Laniarius* spp. showing two examples of duets from Zambia considered to represent mixed pairings and / or intergrades, with characteristics of both the Tropical (southern subgroup) and East Coast groups. For recording credits see Appendix.

Instead the male may duet with a snarl, the converse of duets in the East Coast group, wherein only females produce snarls.

General comments.—In terms of the sound's quality, which is sharp and deeply resonating, the duet stands apart from those of other groups, especially the East Coast group.

East Coast × southern Tropical intergrades (*n* = 3). A small number of duets from southern Tanzania to northern Malawi and northern Zambia were intermediate between the East Coast group and southern subgroup of the Tropical group, suggestive of interbreeding between them (Fig. 5). In one case (Fig. 5a), high, drawn-out flute-like whistles by the male (characteristic of the East Coast group) were combined with slightly higher flute-like whistles of the female (characteristic of Tropical), while in a another (Fig. 5b) a male switched between the gonolek-like varying-pitch note in *too-too too* series (characteristic of the Tropical group) and a phrase consisting of sharp, inflected *twee* and single *too* notes (less common but characteristic of the East Coast group), followed by a hard female scold (also characteristic of the East Coast group), e.g. *kyonk-too-too-too...tweetoo-kaaa*.

Discussion

Vocalisations and taxonomy.—My results are broadly congruent with those of published DNA analyses. The distributions mapped in Fig. 7 integrate the genetic results from Nguembock *et al*. (2008) and Finch *et al*. (2016) with the findings reported here, also taking the literature and previously mapped distributions into account. The vocal evidence

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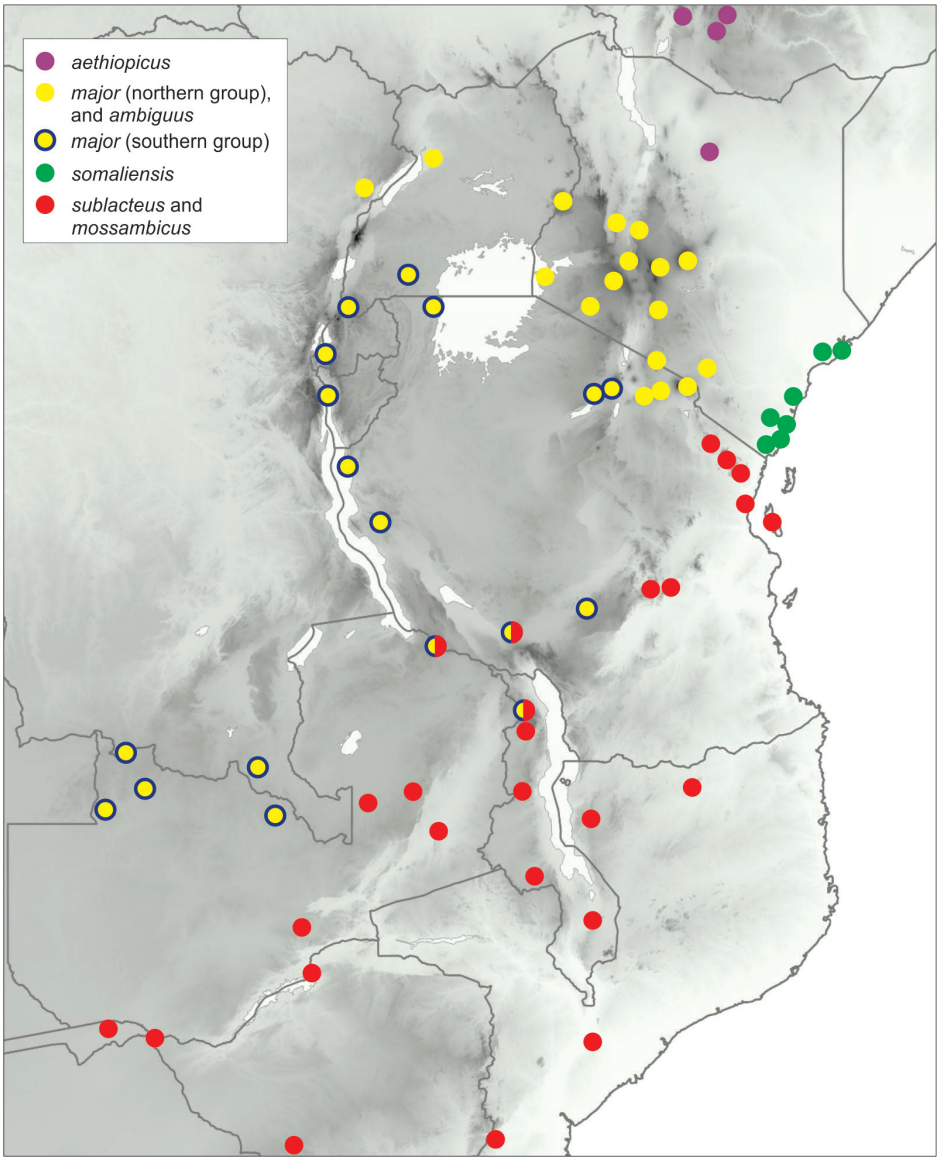


Figure 6. Map showing the locations of audio recordings of pied boubous (*Laniarius* spp.) in East Africa and adjacent regions, allocated to the four distinct groups based on duet type (purple, yellow, green and red markers) and one subgroup (blue and yellow markers) recognised herein. Red and yellow markers denote audio recordings with elements from two different groups, indicating some intergradation.

presented here fully supports the three key findings of genetic studies by Nguembock *et al*. (2008) and Finch *et al*. (2016).

1. Birds referred to *sublacteus* from the Usambara Mountain region in central-east Tanzania are not conspecific with other pied boubous in East Africa (possibly excluding *mossambicus*, which was not sampled by Nguembock *et al*. 2008 but is vocally identical to *sublacteus* and therefore could be conspecific as indicated herein). This is supported by, among other characteristics, the presence of a unique croak note in *sublacteus* (plus *mossambicus*) given by males in duets, and the absence of a whistle from the female repertoire.

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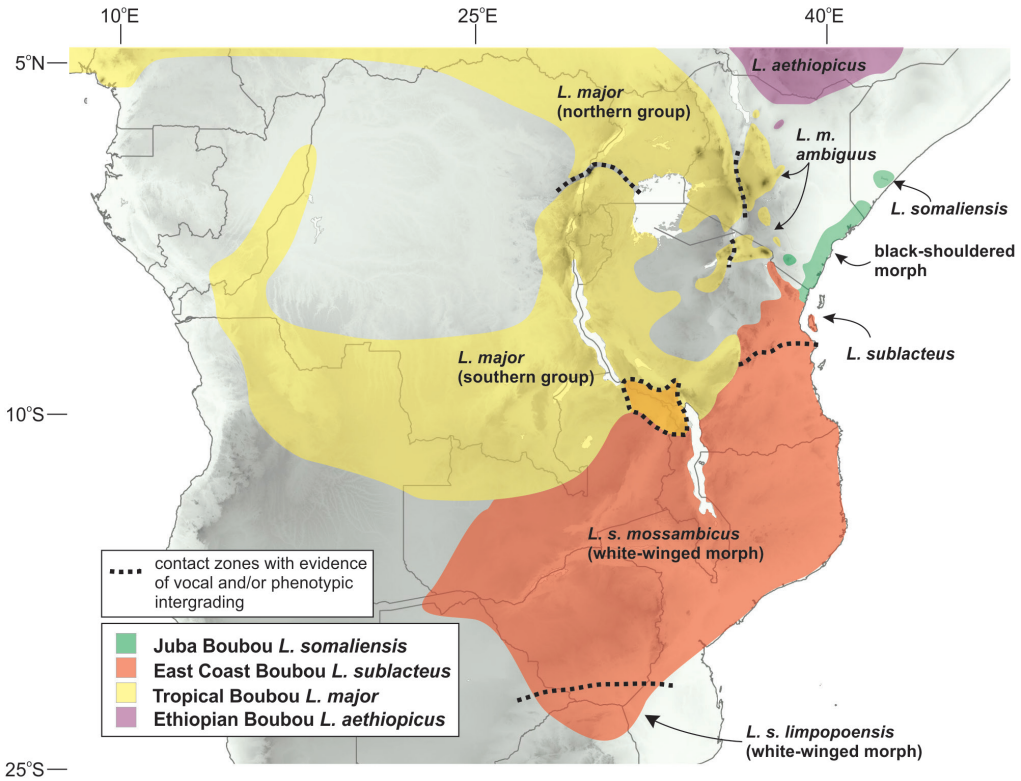


Figure 7. Map showing the distribution of the species and subspecies in the pied boubou complex (*Laniarius* spp.) in East Africa, as inferred from vocal analyses in this study and previous genetic studies (Nguembock *et al*. 2008, Finch *et al*. 2016).

2. Taxon *somaliensis* is a different species from *sublacteus*, despite their identical appearance. Although the latter ranges to areas immediately south of Kenya in north-east Tanzania, populations of *somaliensis* are vocally consistent throughout coastal Kenya from Shimoni and the Shimba Hills north to at least Manda Island, and do not overlap in voice with adjacent *sublacteus* (Fig. 7), but rather utter mellow bell-like notes mixed with sharper varying-pitch notes. While there are no known recordings from southern coastal Somalia (J. Miskell *in litt*. 2020), it is expected that birds there will be vocally consistent with birds on the Kenya coast, as their similar genotype suggests.

3. The relationship between birds in the northern subgroup of the Tropical group and the Ethiopian group is comparatively close relative to that between these forms and both the East Coast and Somali groups. This is reflected in their duet characteristics: the Tropical group uses rich mellow bell-like notes in multiple series, those of the Ethiopian group are similar with a greater use of snarls, whereas neither of these repertoires shows any significant overlap with either the East Coast or Somali groups.

Further attesting to the significance of the vocal evidence presented here concerning the two coastal forms, are the prophetic words of Sclater & Moreau (1933) who were well aware of these vocal differences and their implications. They clearly described the voice of *somaliensis*, from just south of the Kenya / Tanzania border on the coastal plain at Tanga (at the southern limit of its distribution), and that of *sublacteus* in the Usambara foothills, only 60 km inland:

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> 'It is a remarkable fact that the calls of the coast and the mountain birds are different, although there seems to be no morphological distinction between them. The call of the Tanga bird consists of three notes with a magnificent bell-like resonance ... [and it] occurs through the savannah immediately inland, but as soon as the Usambara foothills are reached this ringing intonation is heard no more. Throughout the (Usambara) mountains the Boubou utters a very loud double call, never triple. Each of the two notes is a prolonged uninflected fluting whistle, with no metallic clang. Their notes are as consistently distinct as if they belonged to different species.... The female, with perfect synchronisation, replies with a deep groan. I doubt she is capable of producing the whistle'.

This finding is also in line with common regional species distribution patterns, in that the Tanga-Pangani region of Tanzania comprises a significant biogeographical divide on the east coast of Africa. This marks the southern limit of species typical of the Somali biome, such as Golden Palm Weaver *Ploceus bojeri* and Ethiopian Swallow *Hirundo aethiopica*, as well as the northern limit of species more typical of woodland of the southern tropics such as Böhm's Bee-eater *Merops boehmi* and Piping Cisticola *Cisticola fulvicapilla*.

While the evidence presented here supports the recommendation of Nguembock *et al*. (2008) that species status is warranted for *sublacteus*, it also indicates, unexpectedly, that *mossambicus* (currently treated within *L. major* by all authors and not adequately sampled by Nguembock *et al*. 2008) should be united with it. Based on vocalisations, these two taxa, along with the similar-sounding extralimital *limpopoensis*, appear to comprise three subspecies within one discrete genetic lineage. Finch *et al*. (2016) suggested that *mossambicus* may be specifically distinct from *sublacteus*. That conclusion is not supported here, although vocal evidence does argue strongly that *mossambicus* should be transferred to *sublacteus* from *major*.

In Zambia, Dowsett & Dowsett-Lemaire (1980) and Dowsett *et al*. (2008) noted the unique croak note of birds in the Livingstone area (assigned to *mossambicus*), and which is absent in birds from northern Zambia (which they attributed to *major*), a treatment implying they considered the differences in voice to be dialectical. While there is no vocal evidence of intergradation between these taxa over most of Zambia, both specimen evidence and vocalisations are, however, supportive of it in a small area of northern Malawi and northern Zambia (Nyika National Park) to southern Tanzania (Ufipa to Mbeya) (Fry *et al*. 2000). Some duets from this region are characterised by elements from both taxa (Fig. 5), while a specimen from the Mbeya region was recognised as an intergrade and described as *L. hybridus* Neumann, 1899.

Also unexpected, and not uncovered by previous molecular studies, vocalisations suggest the presence of an unrecognised biogeographic division within *major*. Consistent use of a varying-pitch note in the duets of birds in the south of its range, entirely absent to the north, is suggestive of two discrete lineages. The location of the divide is in south-west Uganda, which also marks that between many species pairs with fragmented subtropical distributions (e.g., Northern *Melaenornis edolioides* and Southern Black Flycatchers *M. pammelaena*, Lesser *Lamprotornis chloropterus* and Miombo Blue-eared Starlings *L. elisabeth*, Northern *Ptilopsis leucotis* and Southern White-faced Owls *P. granti*, or Dark-eyed *Melaniparus leucomelas* and Pale-eyed Black Tits *M. guineensis*). The division between southern *major* and *ambiguus* is similarly evident in the Crater Highlands of northern Tanzania, where birds with a varying-pitch duet meet and possibly intergrade with taxon *ambiguus* of areas east of the Rift Valley, at Essimingor to Mt. Meru. This is suggested by photographs of birds that show the white median coverts of both forms, but with white proximal greater coverts as in *major* (black

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in *ambiguus*), and all-black secondaries as in *ambiguus* (two are white in *major*; e.g., see ML 249878891 and ML 291083661). The presence of a varying-pitch note in duets of southern *major* raises the possibility of a relatively close affinity with coastal *somaliensis*, which also has a varying-pitch note. Indeed, some recordings of *major* from northern Zambia are not dissimilar by ear to duets of *somaliensis*.

Nomenclature.—The name East Coast Boubou has been applied to pied boubous of the entire east coast of Kenya and Tanzania by most authors, under the assumption these birds were all one species and referable to *sublacteus* (e.g., Britton 1980). More recently, the same name has again been used in conjunction with *sublacteus*, particularly for birds in north-east Tanzania (i.e. not those birds genetically matching *somaliensis* in coastal Kenya; Nguembock *et al*. 2008). The vocal data presented here support the genetic discovery that north-east Tanzanian birds are not closely related to those in coastal Kenya, and I propose that the English name East Coast Boubou should also include the taxa *mossambicus* Fischer & Reichenow, 1880, and *limpopoensis* Roberts, 1922 (Fig. 7). While Clements *et al*. (2019) currently use Zanzibar Boubou for *L. sublacteus*, East Coast Boubou is preferred here to reflect the extensive distribution of subspecies *sublacteus* and *mossambicus* in coastal Tanzania from the Saadani–Pangani region southwards.

Of importance to the taxonomy and nomenclature of birds of coastal Kenya (see below) is justification for their referral to *somaliensis* here. Finch *et al*. (2016) opted not to assign a name to birds on the Kenya coast although the genetic data pointed to conspecificity with *somaliensis*, because of uncertainty over the type locality of the form *sublacteus*, labelled 'Eastern Africa' (Cassin 1851, *vide* Grant & Mackworth-Praed 1944). With the origin and precise type locality of *sublacteus* not considered traceable, several locations in coastal Kenya were posited, apparently arbitrarily (Grant & Mackworth-Praed 1944, 1947). Irrespective of exactly where, it seems likely that coastal Kenya was suggested simply because birds with the phenotype of *sublacteus* had been collected there.

The improbability that the type locality of *sublacteus* is in Kenya can be inferred from details of the 12,500+ bird specimen collection belonging to François Massena, Second Duke of Rivoli, which the Academy of Natural Sciences of Philadelphia acquired in 1844. From this collection, ten specimens were described as new species, three with type localities designated as Zanzibar (Cassin 1851), so at least some material originated there. Collection of birds from what is now Kenya did not commence until Baron von der Decken's expedition in 1859 (D. A. Turner *in litt*. 2021) and the first specimens known from mainland Tanzania were taken during the expedition of Captain J. H. Speke in 1860 (N. Baker *in litt*. 2021). Therefore, *sublacteus* can have originated only from Zanzibar, which European naturalists visited from the 1820s onwards. It therefore seems justified to refer birds on the Kenya coast to *somaliensis*, and while a genetic study of the *sublacteus* type specimen is planned (B. Finch *in litt*. 2021), the treatment proposed here seems appropriate in the absence of contradictory DNA evidence.

Meanwhile, *somaliensis* was afforded the English name Juba Pied Shrike by van Someren (1932), reflecting its type locality 'Unterlauf des Ganale' (i.e. 'lower course of the Ganale'; Reichenow 1905), generally thought to be the Juba River. To draw much-needed awareness to the conservation plight of the lower Juba's riverine forests, which are currently experiencing severe levels of deforestation, the name Juba Boubou is proposed here for *L. somaliensis*.

Conclusion

This study, based on vocal differences, supports the findings of Nguembock *et al*. (2008) and Finch *et al*. (2016) that two distinct and unrelated species of pied boubous should be recognised on the East African coast, with the English name East Coast Boubou for

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L. sublacteus, as already in use, and Juba Boubou, as recommended here, for *L. somaliensis*. Vocal data also suggest that white-winged *mossambicus* is better aligned with black-winged *sublacteus* than with white-winged *major*, again supporting statements by Nguembock *et al*. (2008) that plumage criteria are unreliable indicators of taxonomic affinity. Meanwhile, vocal evidence also suggests southern populations of Tropical Boubou *L. m. major* are worthy of further taxonomic investigation, based on consistent vocal differences from northern populations.

Future work on this complex in East Africa should seek to ascertain several outstanding details raised by the treatment proposed here. First, DNA comparisons between *sublacteus* and *mossambicus* are needed to test the hypothesis of conspecificity, or if *mossambicus* is better considered specifically. Second, audio recordings of the white-shouldered morph of *somaliensis* in south-coastal Somalia should be obtained and compared with those of the black-shouldered morph of *somaliensis* in coastal Kenya, to test previous genetic findings of conspecificity. Third, DNA comparisons of *major* from the southern (e.g. Zambia to western Tanzania) and northern (west Kenya to Cameroon) parts of its range should test my vocal data, that these birds may comprise two separate lineages.

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Appendix: Details of recordings used in the figures. ML = Macaulay Library catalogue number, XC = Xeno-canto catalogue number, NP = National Park.

Taxon (subgroup)	Location	Country	Catalogue	Recordist
aethiopicus	Marsabit	Kenya	ML 8718	Marian McChesney
aethiopicus	Melka Ghebdu	Ethiopia	XC 277886	Andrew Spencer
aethiopicus	Awassa	Ethiopia	XC 417288	Nicolas Martinez
aethiopicus	Wondo Genet	Ethiopia	XC 82639	David Marques
aethiopicus	Gibe Gorge	Ethiopia	XC 300393	Peter Boesman
ambiguus	Chyulu Hills	Kenya	ML 65696	Jennifer Horne
ambiguus	Aberdares	Kenya	ML 8794	Myles North
ambiguus	Mt. Kenya	Kenya	ML 8770	Myles North
ambiguus	Mt. Kenya	Kenya	ML 97979	Ian Sinclair
major (northern)	Gwassi Hills	Kenya	XC 294873981	James Bradley
major (northern)	Tugen Hills	Kenya	XC 299939461	James Bradley
major (northern)	Cape Coast	Ghana	ML 87080	David Moyer
major (northern)	Meiganga	Cameroon	XC 100525	Hans Slabbekoorn
major (northern)	Gwassi Hills	Kenya	XC 291874011	James Bradley
major (northern)	Lolgorien	Kenya	ML 90398081	Nathan Hentze
major (northern)	Nyankunde	DR Congo	ML 1515	Peter Kaestner
major (southern)	Minziro Forest	Tanzania	ML 46017	David Moyer
major (southern)	Lake Mburo	Uganda	XC 282014	Rolf de By
major (southern)	Kigali	Rwanda	XC 95097	Rory Nefdt
major (southern)	Sitebe	Tanzania	XC 83841	David Moyer
major (southern)	Ngorongoro	Tanzania	ML 17985	Ted Parker
major (southern)	Salujinga	Zambia	ML 24878	Stuart Keith
mossambicus	Mzimba	Malawi	XC 311672	Frank Lambert
mossambicus	Mutulanganga	Zambia	XC 525297	Daniel Danckwerts
mossambicus	Nyika NP	Malawi	XC 365029	Frank Lambert
mossambicus	Kasanka NP	Zambia	XC 339236	Peter Boesman
mossambicus	Save Valley	Zimbabwe	XC 131619	Mark Harper
somaliensis	Sokoke Forest	Kenya	XC 456803	Frank Lambert
somaliensis	Shimba Hills	Kenya	XC 398558	Rory Nefdt
somaliensis	Tiwi	Kenya	XC 118215	Rory Nefdt
somaliensis	Sokoke Forest	Kenya	ML 22619	Stuart Keith
somaliensis	Rabai	Kenya	ML 302858381	James Bradley
somaliensis	Witu Forest	Kenya	ML 8722	Myles North
somaliensis	Dakatcha	Kenya	XC 585821	Colin Jackson
sublacteus	Amani	Tanzania	XC 467150	Peter Ericsson
sublacteus	Saadani NP	Tanzania	XC 33824	Marc de Bont
sublacteus	Zanzibar	Tanzania	XC 633936	Louis Hansen
sublacteus	Udzungwas	Tanzania	ML 101328	David Moyer
sublacteus	Amani	Tanzania	XC 473736	Rolf de By
sublacteus	South Pares	Tanzania	XC 510216	Peter Boesman
major (southern) × *mossambicus*	Nyika NP	Zambia	XC 398090	Peter Boesman
major (southern) × *mossambicus*	Lusamba	Zambia	XC 339235	Peter Boesman

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