

Birds of Mount Kisingiri, Nyanza Province, including a preliminary survey of the Gwasssi Hills Forest Reserve and a species new to Kenya

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Summary

Mount Kisingiri comprises a much overlooked highland massif in southern Nyanza Province with a hitherto completely unknown avifauna. Here we detail our findings from three brief exploratory visits undertaken between 2011 and 2014, with a focus on forested habitats above 1800 m in the Gwasssi Hills Forest Reserve (GHFR). We confirm the presence of 34 forest-dependent species, including a globally near threatened forest raptor, the Crowned Eagle *Stephanoaetus coronatus*, as well as the first known occurrence of the Western Citril *Crithagra frontalis* in Kenya. Including noteworthy species recorded from other, non-forested areas at lower elevations on the volcano, we provide 46 new or updated (post-1970) distributional records for these two quarter degree atlas squares (60A and 60C). Estimates of species detection probability and abundance, a comparison of forest-dependent species between logged and unlogged sites, and a coarse assessment of overall forest integrity, reveal a highly threatened forest bird community with apparently dwindling numbers of forest specialists. Lastly, we confirm continuing and rapid deforestation in the GHFR and highlight the pressing need for improved forest management and more thorough biodiversity surveys of extant forest.

General study area description

Mount Kisingiri (0°36'S, 34°8'E) is a 13-km wide dormant caldera, situated on the shores of Lake Victoria immediately to the west of the Lambwe Valley in southern Nyanza Province (Fig. 1). With Miocene origins (Allsop & Baldry 1972), it is also one of the older highland massifs in Kenya and marks the westernmost extent of the Kavirondo fault. Portions of the crater rim that remain today, and comprise two of the three main highland areas, include the 2260-m Gwasssi Hills in the south and east, and the 1880-m Gembe Hills in the north. A third highland block rising to 1730 m from the approximate centre of the crater floor and not surveyed as part of this study, is a volcanic plug called Rangwe. Nowhere else in the Lake Victoria basin does shoreline-adjacent terrain rise to such altitudes as at Mt Kisingiri, and highlands of a similar altitude are no closer than the Kisii area, 80 km to the east.

The slopes of Mt Kisingiri are typically steep, particularly those inside of the crater, and in places cliffs of up to 40 m in height add variety to the topography. Precipitation in the towns of Magunga and Mbita at the eastern and northern base of the volcano respectively peaks in March to May and September to December, and measures

approximately 1400 mm annually (World Weather Online 2014). Numerous streams drain the volcano's flanks in a radial pattern and the hills comprise an important water catchment for communities living on the densely farmed plains below.

As recently as the 1970s, the western third of the Gwasssi Hills Forest Reserve (GHFR) comprised an extensive and varied closed-canopy forest (e.g. >70% canopy cover), covering approximately 2000 ha (the eastern two-thirds support drier, non-forested habitats). Significant forest degradation was first noticeable by the early 1980s and pre-empted the first of several evictions of squatters inside the forest (B. Oyungu pers. comm.). Nonetheless, tree felling continued, further damaging the higher forests, while land clearance for farming encroached on the lower forest margins. Following three decades of heavy human pressures, true forest habitats in the GHFR are now both fragmented and much reduced in extent. However, patches of relatively undisturbed forest that remain today, set amid variably logged terrain (canopy cover 20–70%) and second-growth at a range of successional stages, collectively form a diverse forest mosaic landscape. Depending on the altitude, aspect and slope gradient, vegetation characteristics vary considerably, from humid to semi-humid, short to tall, and comparatively open to very dense. A floral inventory has been compiled (O. Ong'ang'a pers. comm.), and forest vegetation is reported to show strong affinities with the forests of Kakamega and the Nandi Hills (GHFCA 2009).

Methods

Study sites

During the course of our study in the GHFR, bird surveys were concentrated in four general areas (see relative effort at each site below), all reached on foot from the road-accessible town of Kisaku at 1800 m on the southern slopes. These sites (Fig. 1), which we describe in more detail below, are named after drainages or locations described in the Gwasssi Hills Draft Forest Management Plan (GHFCA 2009) and cover a range of altitudes and forest types. Dominant plant species were noted when recognized, and species nomenclature follows Dharani (2011). Forest tree species reported to occur in the GHFR (GHFCA 2009) but which we did not encounter and may be preferentially logged include *Antiaris toxicaria*, *Bridelia micrantha*, *Euclea divinorum*, *Harungana madagascariensis* and *Milicia excelsa*.

Mwing'ore (40% relative effort, 9 ha; Fig. 2): a humid and heavily disturbed headwater site at the bottom of a steep south-facing valley at 1870–1950 m. The canopy cover of 20–30% consists of remnant trees interspersed with reasonably well-developed secondary growth, a thick leafy understorey and abundant hanging creepers and vines. Dominant forest trees, mostly less than 20 m in height, include *Ficus sur*, *Celtis africana* and *Polyscias fulva*, with smaller numbers of *Albizia gummifera*, *A. coraria*, *Croton macrostachyus*, *Macaranga kilimandscharica* and *Trichilia emetica*. Understorey species include *Acanthus eminens*, *Cyathea manniana*, *Dombeya burgessiae*, *Dracaena steudneri* and morning glory (Convolvulaceae sp.).

Kumuruga (35% relative effort, 6.5 ha; Fig. 3): a semi-humid and less disturbed ridgetop site at 2060–2110 m. The canopy cover of 90–100% is approximately 15–20 m high, with a dark and fairly open understorey containing small evergreen saplings, woody vines and a heavy layer of leaf litter. Dominant forest trees include *Catha edulis*, *Celtis africana* and *Vepris nobilis*, with smaller numbers of *Polyscias fulva*, *Prunus africana* and *Sapium ellipticum*. Woody vegetation in the understorey included *Carissa edulis*, *Ficus exasperata*, and *Rhus natalensis*. Where the terrain drops steeply to the east

(and elsewhere on the steepest slopes), *Catha edulis* forms uniform stands of 10–15 m in height, and is probably the most abundant forest tree in the hills. Between 2011 and 2014 alone, 30% of this small forest fragment was removed for timber and/or charcoal production.

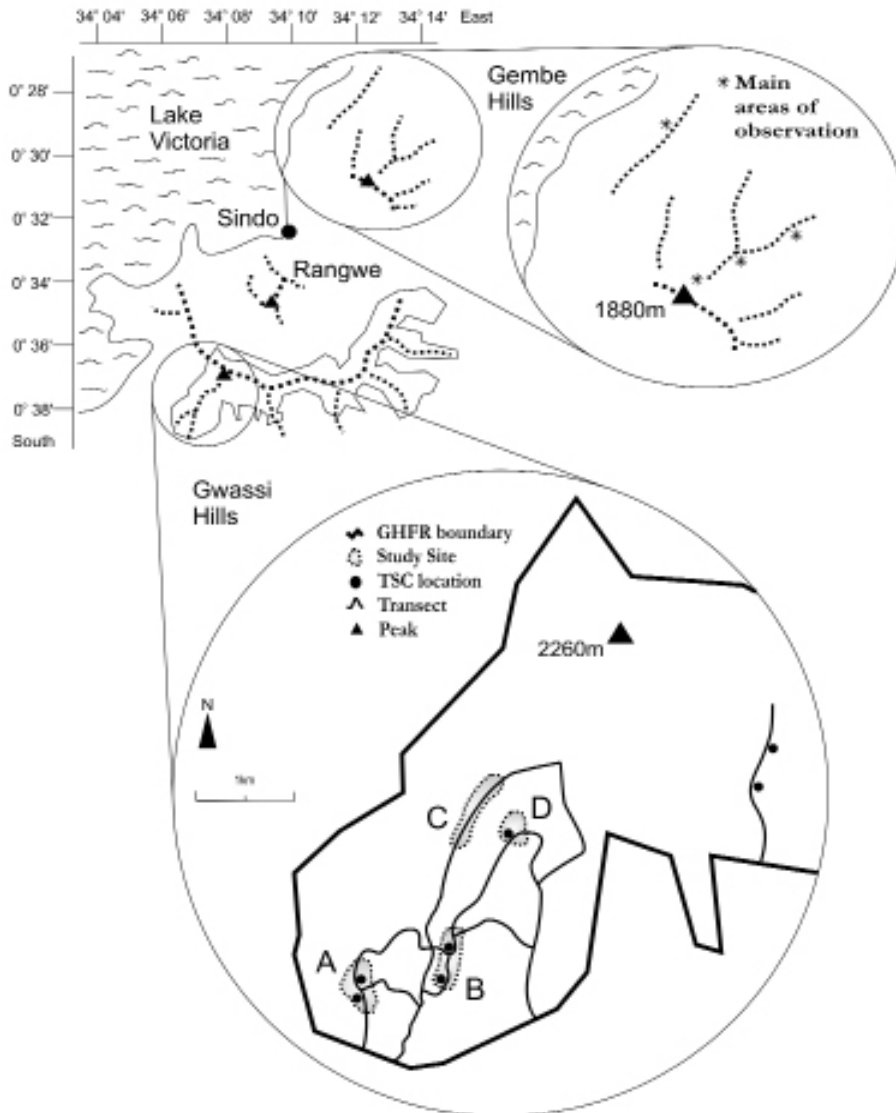


Figure 1. Map of the Kisingiri crater and major ridgelines (top left), showing Lake Victoria, Sindo Town, the northern crater rim (Gembe Hills), central plug (Rangwe), southern Crater Rim (Gwasssi Hills) and Gwasssi Hills Forest Reserve (solid line). Inset maps (with legends) show the Gembe Hills and main observation points (top right), and the Gwasssi Hills Forest Reserve, transect and timed species count locations, and study sites as follows: A–Mwing’ore, B–Kumuruga, C–Rianguge, D–Magama (bottom).



Figure 2. Heavily disturbed and selectively logged habitat at 1900 m on the valley side at Mwing'ore, February 2012.



Figure 3. Relatively undisturbed evergreen and semi-evergreen forest habitat on steep slopes at Kumuruga, February 2012. Gaps visible between the trees on the ridgetop at approximately 2100 m illustrate the damaged character of forest on higher and flatter ground.

Rianguge (10% relative effort, 9.5 ha; Fig. 4): a cooler and very humid ridgetop site on less steeply sloping terrain from 2070 to 2140 m, with vegetation characteristics not dissimilar to Mwing'ore. As is the case along most of the ridgeline, the forest has been heavily logged and comprises a cover of 20% or less, with only a few scattered and commercially unviable tree species remaining amid a dense layer of secondary growth. These remnant forest trees include *Albizia gummifera* and *Polyscias fulva*, with smaller numbers of *Cussonia spicata*, young *Croton macrostachyus* and *Dombeya goetzenii*, as well as some magnificent remnant *Ficus thonningii* reaching 25–30 m in height. Second growth species include abundant *Neoboutonia macrocalyx* and *Dombeya* spp. as well as *Dracena steudneri*, *Solanum* sp., *Ricinus communis* and in places, invasive *Pteridium aquilinum*. One or more *Eucalyptus* sp. are established throughout this and other heavily disturbed areas, and on higher westward-facing slopes here (>2100 m), abundant “old man’s beard” hangs from the trees.

Magama (15% relative effort, 5 ha; Fig. 5): a humid, less disturbed and floristically rich headwater site on slopes adjacent to recently abandoned farmland at approximately 2030–2080 m. The canopy cover of 70–80% includes abundant hardwood trees, some reaching over 30 m in height. Dominant species include *Prunus africana*, *Trichilia emetica* and *Vepris nobilis*, with smaller numbers of *Albizia* spp., *Catha edulis*, *Celtis africana*, *Diospyros abyssinica* and *Polyscias fulva*. The understory is variable, being dark, and open in places, but mostly cluttered with *Dombeya burgessiae*, *Neoboutonia macrocalyx* and morning glory (*Convolvulaceae* sp.) where light penetrates the highly stratified canopy. This area of forest remained relatively unaffected by illegal tree felling during the period of this study.



Figure 4. Heavily logged and disturbed ridgetop forest and secondary growth at 2100 m at Rianguge, February 2012.



Figure 5. Tall and humid forest at approximately 2050 m at Magama is floristically rich with a highly stratified canopy, November 2014.

Data collection

We collected information on the avifauna of Mt Kisingiri, and primarily the GHFR, during three visits: 18–19 January 2011 (JB), 21–24 February 2012 (JB and DB) and 1–6 November 2014 (JB and TI). Surveys in the GHFR were conducted on nine separate days, covering a total of 47.5 km on foot (Fig. 1). Due to challenging access conditions, only a limited amount of time was spent at the highest areas above 2100 m. We also made casual observations on birds in the non-forested Gembe Hills, as well as at lower elevations outside of the forest reserve in the Gwasssi Hills, during several short visits on five separate days. Data were collected as follows:

- 1) We considered each day-visit to the GHFR as a discreet survey unit and the routes walked on each of those visits as a transect. For each transect (day-visit) we recorded the distance covered, the number of times a species was encountered, the total number of individuals detected as well as additional notes on breeding activity. Transects included both return-routes and circuit routes.
- 2) In 2014, limited mist-netting was conducted to sample understorey species in the GHFR. We conducted three morning and three afternoon mist-netting sessions from 2 to 5 November using 2–5 nets (nets of 8–12 m used variably), with most effort at Mwing'ore (480 net-metre h) and less effort at both Kumuruga (152 net-metre h) and Magama (108 net-metre h). Birds were fitted with Ringing scheme of eastern Africa rings, and standard biometric measurements and details of breeding condition were recorded.
- 3) In 2014, we conducted ten timed species counts (TSCs) at seven count stations (see Fig. 1) in the GHFR, to provide an additional index of species detection probability and relative abundance. Timed species counts followed Pomeroy & Tengecho (1986), but were adapted from four 15-min count periods to four 10-min periods, and all birds detected were included instead of only those within 20 m.
- 4) On visits to all areas, but primarily in the GHFR in 2012 and 2014, both targeted and automated audio recording was used to confirm the presence of species, which may have been unidentified or overlooked in the field.

Data analysis

We derived estimates of detection probability as a proportion of either the total number of transects ($n = 9$) or TSCs ($n = 10$) on which a species was recorded. Estimates of relative abundance (commonness) from transect data were derived by multiplying the mean number of individuals recorded per transect-day by the number of transect days on which that species was actually recorded. Estimates of relative abundance from TSCs (Pomeroy & Tengecho 1986) were made by ranking the species according to the count period (1–4) in which the species was detected, before tallying the rank numbers and averaging across the total number of TSCs. This method assumes that more abundant species will be recorded earlier in the TSC. Species were also classified according to ecological niche as Forest Specialists, Forest Generalists, Forest Visitors (as per Bennun *et al.* 1996), or Non-forest Species. We compared the presence/absence of representatives from each of the two forest-dependent groups (specialists and generalists) across both heavily disturbed and relatively undisturbed forest sites to assess general forest health in the GHFR. Species density is also widely used as a proxy for habitat quality (Fuller 2012), and we made further inferences about forest health by comparing the relative abundance of forest generalists with forest specialists.

Results and discussion

Mist-netting

In total, 16 individuals representing ten species were captured and ringed during 740 net-metre h (Table 1). Including an additional three birds captured but not ringed, this represents a capture rate of 1 bird per 38.9 net-metre h. All ringed birds were captured at Mwing'ore.

Table 1. Species trapped and ringed in the GHFR, 2–5 November 2014. *Indicates an adult with a vascularized or recently vascularized brood patch, indicative of active breeding.

Species	# Adults	# Juveniles / Immatures	Not ringed
Tambourine Dove <i>Turtur tympanistria</i>	1		
Narina Trogon <i>Apaloderma narina</i>			1
African Paradise Flycatcher <i>Terpsiphone viridis</i>	1		
Grey-capped Warbler <i>Eminia lepida</i>	1		
Grey-backed Camaroptera <i>Camaroptera brachyura</i>	1		
Yellow-whiskered Greenbul <i>Andropadus latirostris</i>	2*	1	
Cabanis's Greenbul <i>Phyllastrephus cabanisi</i>	3	2	1
Garden Warbler <i>Sylvia borin</i>	1		
Blackcap <i>Sylvia atricapilla</i>	1		
Red-capped Robin Chat <i>Cossypha natalensis</i>	1		1
Green-headed Sunbird <i>Cyanomitra verticalis</i>	1*		

Species richness and abundance in the GHFR

In total, we detected 92 bird species inside the GHFR: 89 during transect observations, and an additional three detected only during TSCs (see Appendix 1 for a full species list for Mt Kisingiri). Of the 92 species recorded, 34 were forest dependent, of which 13 were forest specialists and 21 were forest generalists. The remaining 58 species

comprised 32 forest visitors and 26 non-forest species (Bennun *et al.* 1996). This is a little more than one-third of the number of forest-dependent species recorded in the nearby Trans Mara Forest (Bennun 1991), and quite rich for an isolated and comparatively small forest.

Coarse estimates of abundance for species recorded on three or more visits show that Grey-backed Camaroptera *Camaroptera brachyura*, Tropical Boubou *Laniarius aethiopicus* and Common Bulbul *Pycnonotus barbatus*, all birds that adapt well to disturbed habitat, are the three commonest species (Table 2). While it seems likely that our surveys overestimate the abundance of Tropical Boubou as a result of its far-carrying song, these were noticeably abundant here relative to other western Kenyan forests (pers. obs.). The abundance of these three species, and the presence of many more forest generalists compared to forest specialists (21 vs. 13), is typical of a forest ecosystem characterized by an abundance of secondary growth and edge habitats. The higher abundance of forest generalists was also reflected in the detection probabilities, with 50% of forest generalists and 38% of forest specialists detected on three or more of the nine survey days.

Confirmed breeding records in the GHFR

We confirmed breeding for nine species inside the GHFR as follows:

Wahlberg's Eagle *Aquila wahlbergi* – adult defending nest in February 2012 and sitting on nest in November 2014

Crowned Eagle *Stephanoaetus coronatus* – recently fledged juvenile in January 2011

Grey Apalis *Apalis cinerea* – recently fledged young in February 2012

Yellow-whiskered Greenbul *Andropadus latirostris* – immatures seen and ringed in November 2014

Cabanis's Greenbul *Phyllastrephus cabanisi* – juvenile ringed in November 2014

White-eyed Slaty Flycatcher *Melaenornis fischeri* – immature with buff-spots on the wings in November 2014

Collared Sunbird *Hedydipna collaris* – recently fledged young in November 2014

Green-headed Sunbird *Cyanomitra verticalis* – female with brood patch in November 2014

Spectacled Weaver *Ploceus ocularis* – nest building in November 2014

Additionally, the following two species were confirmed breeding immediately adjacent to the forest reserve:

Common Fiscal *Lanius collaris* – recently fledged young in January 2011

Brimstone Canary *Crithagra sulphurata* – recently fledged young in November 2014.

Table 2. Indices of species detection probability and relative abundance for common species in the GHFR; TSC = Timed species counts

Species	Transect detection probability (%)	Transect abundance index	TSC detection probability (%)	TSC abundance index
Grey-backed Camaroptera <i>Camaroptera brachyura</i>	100	90.00	100	4.0
Tropical Boubou <i>Laniarius aethiopicus</i>	100	67.00	100	4.0
Common Bulbul <i>Pycnonotus barbatus</i>	100	61.00	90	3.2
Blackcap <i>Sylvia atricapilla</i>	100	50.00	10	0.3
Northern Double-collared Sunbird <i>Cinnyris reichenowi</i>	100	50.00	100	3.5
Yellow-whiskered Greenbul <i>Andropadus latirostris</i>	100	39.00	100	3.7
Red-faced Cisticola <i>Cisticola erythrops</i>	100	39.00	10	0.4
Cabanis's Greenbul <i>Phyllastrephus cabanisi</i>	100	33.00	50	1.5
Common Buzzard <i>Buteo buteo</i>	89	47.11	20	0.6
Ross's Turaco <i>Musophaga rossae</i>	89	30.22	20	0.5
Brown-throated Wattle-eye <i>Platysteira cyanea</i>	89	17.78	60	1.7
White-bellied Tit <i>Parus albiventris</i>	89	16.89	60	1.4
Collared Sunbird <i>Hedydipna collaris</i>	89	16.00	80	2.1
Yellow-rumped Tinkerbird <i>Pogoniulus bilineatus</i>	89	15.11	60	2.0
Spectacled Weaver <i>Ploceus ocularis</i>	89	9.78	20	0.5
Grey Apalis <i>Apalis cinerea</i>	78	35.00	90	2.9
African Yellow White-eye <i>Zosterops senegalensis</i>	78	31.11	50	1.7
Red-capped Robin Chat <i>Cossypha natalensis</i>	78	17.11	80	2.8
Black-backed Puffback <i>Dryoscopus cubla</i>	78	15.56	60	1.9
White-eyed Slaty Flycatcher <i>Melaenornis fischeri</i>	78	15.56	10	0.1
Baglafaecht Weaver <i>Ploceus baglafaecht reichenowi</i>	78	12.44	30	0.8
Cardinal Woodpecker <i>Dendropicos fuscescens</i>	78	7.00	20	0.5
Augur Buzzard <i>Buteo augur</i>	67	7.33	20	0.3
Wahlberg's Eagle <i>Aquila wahlbergi</i>	67	6.00	10	0.4
Klaas's Cuckoo <i>Chrysococcyx klaas</i>	67	5.33	20	0.5
Rock Martin <i>Ptyonoprogne fuligula</i>	67	5.33		
Sharpe's Starling <i>Pholia sharpii</i>	56	12.22	10	0.1
Tambourine Dove <i>Turtur tympanistria</i>	56	10.00	40	1.2
White-headed Saw-wing <i>Psadiloprocne albiceps</i>	56	9.44	10	0.2
Grey-capped Warbler <i>Eminia lepida</i>	56	9.44	90	3.4
Amethyst Sunbird <i>Chalcomitra amethystina</i>	56	9.44	30	0.8
Western Citril <i>Crithagra frontalis</i>	56	7.78		
Narina Trogon <i>Apaloderma narina</i>	56	5.33	30	0.8
Red-eyed Dove <i>Streptopelia semitorquata</i>	56	3.33		
Bronze Sunbird <i>Nectarinia kilimensis</i>	44	5.78	10	0.1
African Paradise Flycatcher <i>Terpsiphone viridis</i>	44	3.11	60	2.1
Black Cuckooshrike <i>Campephaga flava</i>	44	1.78		
Common Fiscal <i>Lanius collaris</i>	44	1.78	10	0.2
Slender-billed Greenbul <i>Andropadus gracilirostris</i>	44	1.78		
Garden Warbler <i>Sylvia borin</i>	44	1.78		

Species	Transect detection probability (%)	Transect abundance index	TSC detection probability (%)	TSC abundance index
Red-rumped Swallow <i>Cecropis daurica</i>	33	3.67		
Speckled Mousebird <i>Colius striatus</i>	33	3.33	20	0.5
Willow Warbler <i>Phylloscopus trochilus</i>	33	3.33		
Black-billed Weaver <i>Ploceus melanogaster</i>	33	2.67	10	0.1
Blue-spotted Wood Dove <i>Turtur afer</i>	33	1.67		
White-browed Coucal <i>Centropus superciliosus</i>	33	1.33	40	0.7
White-browed Robin Chat <i>Cossypha heuglini</i>	33	1.33	10	0.4
Long-crested Eagle <i>Lophaetus occipitalis</i>	33	1.00		
Brown-crowned Tchagra <i>Tchagra australis</i>	33	1.00		
Scarlet-chested Sunbird <i>Chalcomitra senegalensis</i>	33	1.00	30	1.2
Yellow-bellied Waxbill <i>Coccyzygia quartinia</i>	33	1.00		
Tree Pipit <i>Anthus trivialis</i>	33	1.00		

Probable breeding in the GHFR

We considered species as probable breeders in the GHFR, based on three criteria: (1) display behaviour of males or pairs during the breeding season (as per Brown & Britton 1980); (2) the presence of multiple (>4) territorial counter-singing males; and (3), a sedentary life history, and/or geographic isolation and habitat specialization (i.e. forest dependence). Those species which meet the last criterion, but were found in low abundance and therefore may not be breeding successfully were not included. The following species were probable breeders: Tambourine Dove *Turtur tympanistria*, Ross's Turaco *Musophaga rossae*, White-browed Coucal *Centropus superciliosus*, Speckled Mousebird *Colius striatus*, Narina Trogon *Apaloderma narina*, Yellow-rumped Tinkerbird *Pogoniulus bilineatus*, Cardinal Woodpecker *Dendropicus fuscescens*, Brown-throated Wattle-eye *Platysteira cyanea*, Black-backed Puffback *Dryoscopus cubla*, Tropical Boubou, White-bellied Tit *Parus albiventris*, Rock Martin *Ptyonoprogne fuligula*, Red-faced Cisticola *Cisticola erythrops*, Chubb's Cisticola *C. chubbi*, Grey-capped Warbler *Eminia lepida*, Grey-backed Camaroptera, Common Bulbul, African Yellow White-eye *Zosterops senegalensis*, Red-capped Robin Chat *Cossypha natalensis*, Amethyst Sunbird *Chalcomitra amethystina*, Northern Double-collared Sunbird *Cinnyris reichenowi*, Baglafaecht Weaver *Ploceus baglafaecht reichenowi*, Black-billed Weaver *P. melanogaster*.

Palearctic migrants

The highland topography of Mt Kisingiri appears to provide benefits to a number of Palearctic migrants. Birds of prey, in particular Common Buzzard *Buteo buteo*, clearly make use of the slopes and ridges on migration, as well as possibly the wooded and forested areas for roosting. Similar concentrations of this species have been observed previously in the eastern Lake Victoria Basin, and this observation fits well with a known autumn migration flyway around the eastern edge of Lake Victoria from Mt Elgon south to northern Tanzania for this species (Britton 1980). Passerine migrants are generally not well represented on Mt Kisingiri but the GHFR may contain important winter habitat for Blackcap *Sylvia atricapilla* and possibly an important refuge for Willow Warbler *Phylloscopus trochilus* during very dry periods.

This species was especially abundant in January 2011 when surrounding lower altitudes were very dry, but it was largely absent on other visits when the region was wetter.

Comparison with other forest and highland bird faunas

Although our surveys were of limited extent and our species list is undoubtedly incomplete, the following points can be made about Mt Kisingiri's avifaunal affinities:

- (1) All of the forest dependent species we recorded in the GHFR are also known to occur in the Kakamega-Nandi Forest block, 115 km to the northeast. However, some species more characteristic of montane habitats are absent (Black-fronted Bushshrike *Chlorophoneus nigrifrons*) or scarce (Sharpe's Starling *Pholia sharpii* and White-browed Crombec *Sylvietta leucophrys*) below 1700 m in Kakamega Forest, being commoner or more characteristic above 1800 m in the Nandi forests (Britton 1980, Lewis & Pomeroy 1989, eBird 1991, Zimmerman *et al.* 1996, Shanni & Bruijn 2006).
- (2) Most of the forest-dependent species in the GHFR have also been recorded from the Nyakweri Forest and other forest patches in the Lolgorien area 110 km to the southeast (eBird 1991, Zimmerman *et al.* 1996). Species not yet recorded from there, but which we found to occur in the GHFR include Chubb's Cisticola, White-browed Crombec, Sharpe's Starling and Black-billed Weaver.
- (3) With the exception of Least Honeyguide *Indicator exilis*, all of the forest dependent species we recorded in the GHFR can also be found in the forests of Mt Elgon (Lewis & Pomeroy 1989, Zimmerman *et al.* 1996), another, though less isolated volcano on the periphery of the West Kenyan highlands. Given that the honeyguide has been recorded only 35 km away at Kapenguria, and may well occur undetected at Mt Elgon, this mountain appears to support a bird fauna most similar to that of Mt Kisingiri.
- (4) An assemblage of non-forest species at Mt Kisingiri, occurring in grass and bush habitats on steep and rocky slopes, also bears a close similarity with that found in the Nandi and Lolgorien areas. Several characteristic but local species of these habitats, including Rock-loving Cisticola *Cisticola emini*, Familiar Chat *Cercomela familiaris*, Little Rock Thrush *Monticola rufocinereus* and Long-billed Pipit *Anthus similis* are also known from steep slopes separating high plateaux from adjacent lowlands at both the Kavirondo Escarpment, 100 km to the northeast (Bradley & Bradley 2014), and the Oloololo Escarpment, 115 km to the southeast (eBird 1991, Zimmerman *et al.* 1996).

Birds species in logged vs. unlogged forest

The canopy characteristics and tree species composition of our sites permits a coarse comparison between the presence/absence of forest dependent species in heavily logged and disturbed forests (Mwing'ore and Rianguge) versus mostly unlogged and relatively undisturbed forests (Kumuruga and Magama). While this comparison showed a strong positive association between the presence of forest specialists versus forest generalists at unlogged sites (Table 3), as might be expected, the difference was not statistically significant (two-tailed Student *t*-test; $t = 3.35$, $P = 0.07$).

Table 3. Relative presence/absence of forest specialists and forest generalists at disturbed and undisturbed sites.

	Heavily disturbed forest			Relatively undisturbed forest		
	Mwing'ore	Rianguge	combined	Kumuruga	Magama	combined
Relative effort (% time)	40	10	50	35	15	50
Approximate canopy cover (%)	30	20	--	90	70	--
# Forest dependent species (total)	19	12	22	20	18	26
Generalists	13	9	14	11	10	14
Specialists	6	3	8	9	8	12
Ratio (Generalist : Specialist)	2.2 : 1.0	3.0 : 1.0	1.8 : 1.0	1.2 : 1.0	1.3 : 1.0	1.2 : 1.0

Ranking and comparing the relative abundance of species within the two forest dependent niches (generalists and specialists) also permits a coarse appraisal of forest ecosystem integrity. We found that across the GHFR, the relative abundance of forest generalists appeared normal, as might be expected in an environment characterized by an abundance of secondary growth and forest edge habitat (Fig. 6). Approximately a quarter of the species recorded were considered very abundant, a quarter of moderate abundance, and the remaining half were rare. However, among forest specialists, relative abundance was distorted, with only a quarter of species being quite common or moderately so, with the remaining three quarters being very rare. This imbalance in relative species abundance within a defined ecological niche could be interpreted as an early warning sign that disturbance to forest interior ecosystems in the GHFR is compromising the viability of forest specialist bird populations.

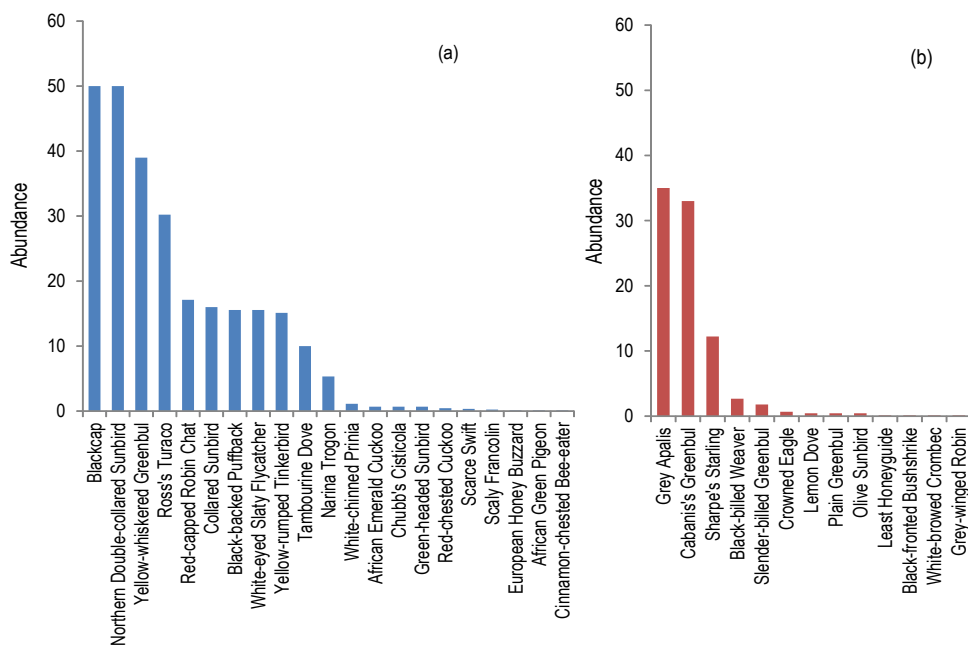


Figure 6. Ranked relative abundance of (a) forest generalists and (b) forest specialists in the Gwass Hills Forest Reserve.

Forest health, threats and management

Our assumptions of deteriorating forest integrity based on bird species occurrence and abundance, are also supported by field observations and satellite imagery. We found that most of the well differentiated and floristically rich forest above 1800 m has been heavily logged, with intact and less disturbed fragments largely restricted to steeper slopes and the most remote headwaters. Removal of trees has been highly selective, targeting the tallest and most commercially desirable hardwood species on the flatter ridgetops and summit. Much of these areas are now characterized by widely spaced and commercially unviable tree species interspersed with thick and creeper-laden secondary growth.

Using satellite imagery and simple, polygon-based arial measurements in GIS (Quantum GIS 2.6.1; <http://www.qgis.org/en/site/#>), we calculated that intact, or near-intact closed canopy forest (i.e. >70% canopy cover) now covers less than 250 ha of the GHFR. This cumulative measurement of forest area can be divided between roughly nine main fragments ranging in size from 5 to 110 ha, with the two largest fragments, also the least diverse floristically, covering approximately 170 ha of the near-inaccessibly steep crater walls. Our estimate is comparable with that reported in the Gwassi Hills Draft Forest Management Plan equating to 93–95% forest loss since 1980 (GHFCA 2009).

Land-use activities currently contributing to forest loss and degradation inside the GHFR are numerous and pervasive. We observed the continued felling of trees, many over 25 m tall, for their value as both timber and fuel, and much of which is organized to supply markets in the densely populated surroundings as far as Kisumu (B. Oyungu pers. comm.). Large trees are also felled only to harvest honey from natural bee hives, with the destroyed tree unused. Natural forest regeneration is hindered through periodic burning of damaged forest, repeated clearance of small patches for illicit distilleries or crop cultivation, and grazing of cattle along the few watercourses. The typically thick and creeper-laden layer of secondary growth resulting from this high level of disturbance is also thought to present a physical impediment to the recruitment of forest trees (GHFCA 2009). On a wider scale, forest loss is thought to be responsible for increasingly intermittent and unreliable discharge from streams draining the GHFR (B. Oyungu pers. comm., GHFC 2009).

Administration of the GHFR is undertaken by the Kenya Forest Service, with support from local and regional-based community conservation groups. A well-conceived management plan has been written, but implementation appears to be slow and intermittent due to equipment and funding shortages. From our observations, three principal limitations are evident, all of which point to an enforcement presence in and immediately surrounding the forest reserve that is insufficient to deter continuing illegal forest exploitation:

- (1) Resources are not being allocated such that forest patrols can be conducted on anything more than a sporadic basis;
- (2) A patrol of only four forest officers is too few to effectively counter the numerous illegal activities across the entire forest reserve;
- (3) An operations base in the town of Magunga, in the eastern foothills and over 5 km from the nearest parts of the forest reserve, is too distant to be a visible and effective enforcement presence.

Conversations with people in communities surrounding the forest suggest that a permanent presence of forest officers based at the forest edge, in combination with regular patrols throughout the forested areas of the reserve, would constitute a significant and immediate deterrent to further deforestation.

Species conservation

The most endangered species occurring in the GHFR is possibly Crowned Eagle, listed by Birdlife International (2014) as globally threatened. Breeding was apparently successful in 2010–2011, suggesting that the extent of forest and prey base may still be suitable for this species. However, based on a failure to record this species during six days in November 2014, it may have been extirpated during the course of this study. Two species are also listed as regionally vulnerable, Least Honeyguide and Grey-winged Robin *Sheppardia polioptera* (Bennun & Njoroge 1999) and they may also be highly threatened here based on only single records of each. A further four forest specialists, Black-fronted Bushshrike, Plain Greenbul *Andropadus curvirostris*, White-browed Crombec and Olive Sunbird *Cyanomitra olivacea* were found at only one or both of the sites supporting undisturbed forest habitat, and must also be considered highly threatened. By contrast, the remaining six forest specialists (Lemon Dove *Aplopelia larvata*, Grey Apalis, Cabanis's Greenbul, Sharpe's Starling, Black-billed Weaver and Slender-billed Greenbul *Andropadus gracilirostris*) were comparatively more abundant or were observed using disturbed habitats. These species could be more adaptable to selectively logged and/or second-growth habitats and corridors, and three species in particular, Lemon Dove, Cabanis's Greenbul and Black-billed Weaver should be somewhat more resilient in the face of forest degradation. They are primarily birds of understorey habitats and are more tolerant of secondary growth.

Species accounts

The accounts below provide additional details of select species recorded in the GHFR as well as elsewhere on Mt Kisingiri as noted. Where relevant, catalogue numbers (or webpage url) are given in brackets after individual species accounts for presentable audio recordings archived at Xeno-canto.org. For a list of all species recorded see Appendix 1. Taxonomy and nomenclature follow the *Checklist of the Birds of Kenya* (EANHS 2009).

Scaly Francolin *Francolinus squamatus*

Two or more birds were heard and recorded calling from the forest edge at Magama in November 2014. It is probably an uncommon and shy resident, which has also been reported from the nearby Lambwe Valley (eBird 1991). [XC205782]

Common Kestrel *Falco tinnunculus*

A single bird seen flying alongside and perching on a high cliff in November 2014 may have been resident in the area.

Eurasian Hobby *Falco subbuteo*

A single adult was observed perched in a dead tree on a ridge at 2100 m in November 2014. On migration, this is a fairly common bird in the adjacent Lambwe Valley (JB pers. obs.), perhaps only occasionally wandering to nearby higher altitudes.

Lanner Falcon *Falco biarmicus*

Two or more pairs are probably resident across the volcano, and were seen around

cliffs and steep terrain above 1800 m in both the Gwassi and Gembe Hills. Breeding in the latter area was suggested by aggressive mobbing by a pair near a cliff in February 2012. Of note, two distinct colour morphs were observed: two pairs with entirely white underparts, speckled with black, and a pair with entirely cinnamon-rufous underparts marked similarly. [XC101188]

Peregrine Falcon *Falco peregrinus*

An adult soaring southwards over a ridge at 1800 m in January 2011 was large, very white below, and probably of the migrant race *F. p. calidus*. There are comparatively few Peregrine records from the southwest corner of Kenya (Lewis & Pomeroy 1989), which may reflect genuine scarcity or merely low observer coverage.

European Honey Buzzard *Pernis apivorus*

Singles were seen soaring over the Gembe Hills in February 2012 and over Mwing'ore in the Gwassi Hills in November 2014. It is probably an uncommon winter resident in more wooded areas of the volcano.

Ovambo Sparrowhawk *Accipiter ovampensis*

An adult was photographed perched in the sub-canopy forest at Kukuruga in November 2014. This is a rare accipiter in Kenya with an incompletely known distribution (Lewis & Pomeroy 1989, Zimmerman *et al.* 1996). While it is resident and regularly reported from the western Masai Mara, 120 km to the east, its status on Mt Kisingiri is unclear.

Common Buzzard *Buteo buteo*

Singles were present most days in February and November, and a loose flock of 42 individuals was seen moving south over a high ridge in the Gwassi Hills on 4 November 2014 over a 20-min period. A smaller southward movement of 10 or more birds was observed over a lower ridge in the Gwassi Hills at 1500 m on 6 November 2014.

Martial Eagle *Polemaetus bellicosus*

Considered globally vulnerable (Birdlife International 2014), adults were observed soaring over high terrain in both Gwassi and Gembe Hills on all visits, associating with single immatures in January 2011 and February 2012. The habitat in the Gwassi Hills is unsuitable for foraging or breeding but there is extensive savanna grassland and suitable prey in the Gembe Hills and adjacent Lambwe Valley and more than one pair is likely resident in the area.

Crowned Eagle *Stephanoaetus coronatus*

Considered globally near-threatened (Birdlife International 2014), a single juvenile was seen soaring low over Rianguge in January 2011, and a pair of adults was observed flying in close formation at Kukuruga in February 2012. Additionally, an adult was observed high over the Gembe Hills in February 2012 flying towards the GHFR. Blue Monkeys *Cercopithecus mitis* are fairly abundant in the higher, forested areas of the GHFR, and probably comprise an important food source for this resident pair.

Lemon Dove *Aplopelia larvata*

In November 2014, a single bird was seen at Magama and a bird heard and recorded at Mwing'ore was thought to be this species. The presence of unseen birds singing an identical song in dense thicket-forest in the Lambwe Valley (also during November

2014) and its apparent absence in the area in January and February, suggests this species may only be a wet season visitor to the GHFR. [XC205756]

Ross's Turaco *Musophaga rossae*

Pairs and small groups were commonly encountered in clusters of remnant trees and forest edge from 1800 to 2200 m.

Common Cuckoo *Cuculus canorus*

A single hatching-year bird was seen and photographed in broken forest and secondary growth at Mwing'ore in November 2014. It is presumably an uncommon winter visitor or passage migrant.

Spotted Eagle Owl *Bubo africanus*

A single bird called intermittently after dark from remnant trees in agricultural land on two nights in November 2014. The bird was not seen but is presumed to be of the nominate subspecies *B. a. africanus*. [XC205763]

Scarce Swift *Schoutedenapus myoptilus*

Two individuals, possibly a male and female pair, were seen closely foraging alongside a partially forested ridge at approximately 2100 m near Magama in February 2012. An additional single bird was seen nearby the same day. Breeding of this species in Kenya is not known with certainty (Lewis & Pomeroy 1989) and its status in the GHFR is unclear.

Horus Swift *Apus horus*

Two birds were seen foraging with Red-rumped Swallows *Cecropis daurica* and Rock Martins *Ptyonoprogne fuligula* above the crater walls in the Gembe Hills in February 2012. It is probably only an irregular visitor to the area from elsewhere.

Narina Trogon *Apaloderma narina*

Reported to be rare in Nyanza Province (Britton 1980), we found it to be fairly common in the remaining canopy forest in the GHFR, where it is probably resident year-round. Birds were much more vocal in January and February than in November.

Cinnamon-chested Bee-eater *Merops oreobates*

A single, vocal bird, was seen foraging from the tops of a tall dead forest tree near Magama in November 2014. It is possibly resident in very small numbers.

Least Honeyguide *Indicator exilis*

A single bird was seen well in remnant forest at Mwing'ore, with the small and squat shape (as in Pallid Honeyguide *I. meliphilus*), as well as dark malar and very dark grey underparts, clearly noted. This species is considered regionally vulnerable by Bennun & Njoroge (1999) and is probably a rare resident here.

Black-fronted Bushshrike *Chlorophoneus nigrifrons*

A single yellow-breasted morph was heard and seen briefly in the sub-canopy forest at Kumuruga in February 2012, foraging with a mixed flock including Sharpe's Starling, Grey Apalis and White-bellied Tit. It is probably rare in the hills and almost certainly threatened by deforestation.

Black Saw-wing *Psalidoprocne pristoptera*

A single bird was seen closely over farmland at 1900 m in January 2011. It is probably only a wanderer to the Gwassi Hills, with no further observations.

Rock Martin *Ptyonoprogne fuligula*

Singles, pairs and small groups were seen in the Gwasssi and Gembe Hills near suitable cliff habitat on all visits, with a pair perched together on a rock face at 1950 m in November 2014. Its occurrence within the Lake Victoria Basin is otherwise known from a single record only (Britton 1980), though it is likely to be resident across Mt Kisingiri in small numbers.

Trilling Cisticola *Cisticola woosnami*

Fairly common and readily detected by its call from 1300 to 1700 m in both the Gwasssi and Gembe Hills, where it was closely tied to bushed grassland on steep slopes.

Chubb's Cisticola *Cisticola chubbi*

Two unseen pairs were heard counter-duetting in overgrown cultivation adjacent to forest edge at 1950 m in January 2011, and a single was seen well and the alarm call recorded in the same area in November 2014. It is presumably an uncommon resident and greatly outnumbered by Red-faced Cisticola *C. erythrope*. [XC205752]

Rock-loving Cisticola *Cisticola emini*

Although not seen in the field, we found the vocalizations of this species in our automated recordings from the Gembe Hills. The calls were recorded at approximately 1500 m in fairly steep and rocky terrain with a vegetation cover of light grass, some shrubs and trees. Our recordings are identical to calls of this species from the nearby Masai Mara (B. Finch pers. comm.), and we suggest that birds here are also referable to *C. e. emini*. [XC162229]

Wailing Cisticola *Cisticola lais*

A presumed pair was seen in degraded scrub on a steep and dry, rocky slope at 1250 m in the Gembe Hills in January 2011. From a distance, the close similarity to Rattling Cisticola *C. chiniana* was noted, but the voice, consisting of a piercing series of high pitched and descending "tweeeee" notes, was highly distinctive and permitted confident identification as this species. Rattling Cisticolas were common in flatter and more densely bushed acacia terrain at the base of the hills but none was detected on the slopes themselves. West of the Kenyan Rift Valley, this species is known only from the Loita Hills (Britton 1980) and the Karapokot area (Malcolm-Coe 1992), both locations more than 200 km from Mt Kisingiri.

White-chinned Prinia *Schistolais leucopogon*

A group of three or more individuals was heard on two days in November 2014, calling from dense herbage and secondary growth along a stream at Mwing'ore. It is presumably a local and uncommon resident.

Grey Apalis *Apalis cinerea*

A common resident, often with mixed-species flocks and readily detected in all areas from 1850 to 2225 m where forest or clusters of remnant forest trees remain. Birds were observed using all forest strata, to as low as 1 m from ground level, and appeared to tolerate quite a high degree of forest disturbance. [XC107408]

Plain Greenbul *Andropadus curvirostris*

A single bird was seen well and perched in hanging, woody vines in the lower-midstorey forest at Kumuruga in January 2011, with the contrasting grey throat and white eye-lids seen clearly. Its purring call was also heard and recorded in February

2012 at the same location. It was undetected in November 2014 and is undoubtedly seriously threatened by forest loss.

Yellow-whiskered Greenbul *Andropadus latirostris*

An abundant resident throughout forest, forest remnants and well established secondary growth from 1850 to 2225 m. [XC163720, XC205780]

Slender-billed Greenbul *Andropadus gracilirostris*

None was seen but the bulbul-like song of this canopy specialist was heard widely but sparingly on all three visits to the GHFR. The soft and slightly squeaky “ook-ee-woo” call was also heard at Magama in November 2014. It is presumably resident at low densities.

Cabanis’s Greenbul *Phyllastrephus cabanisi*

A common resident in the understorey forest and well established secondary growth from 1850 to 2150 m. Birds were considerably more vocal in January and February than in November. [XC101158, XC156989]

White-browed Crombec *Sylvietta leucophrys*

None was seen but the distinct high-pitched rolling trill of this species was heard at Magama in November 2014. It is probably rare in the hills and possibly restricted to the most intact and locally humid areas of forest.

Arrow-marked Babbler *Turdoides jardineii*

Fairly common in thicker bush and thicket from 1250 to 1500 m on the slopes of both the Gwassi and Gembe Hills. They appear to separate ecologically from the sympatric Black-lored Babbler *T. sharpeii* by habitat, with the latter found in flat acacia grasslands at the base of the hills and in the Lambwe Valley.

Sharpe’s Starling *Pholia shapii*

Encountered in widespread forest fragments from 1900 to 2200 m on most visits, where it was easily detected by both its calls and song. Birds were also observed foraging in large remnant trees isolated within areas of secondary growth. This species may wander seasonally in response to the wet seasons or the availability of fruiting trees (Lewis & Pomeroy 1989), but it could also be resident here. In either case, it appears to be present in fairly low numbers, with a maximum of six seen together in February 2012. [XC101202, XC131908]

Grey-winged Robin *Sheppardia polioptera*

This regionally vulnerable species (Bennun & Njoroge 1999) is included on the basis of a brief song heard and recorded at Magama in November 2014, and considered diagnostic for this species (JB pers. obs., B. Finch pers. comm.). Given the suitability of the streamside rainforest habitat, and this species’ abundance along forested streams 40 km to the southeast at Rapogi (Lewis & Pomeroy 1989), its presence in the GHFR can be expected.

Red-capped Robin Chat *Cossypha natalensis*

Regularly heard and seen on all visits throughout areas of forest and secondary growth from 1800 to 2200 m, with birds probably resident and referable to *C. n. hylophona*.

Brown-backed Scrub Robin *Cercotrichas hartlaubi*

Only a single bird, which was confirmed by call, in secondary growth and forest edge habitat at 2000 m in November 2014. [XC205935]

Familiar Chat *Cercomela familiaris*

A single bird was seen well, perched on a small boulder amongst short-grassed woodland at 1275 m at the foot of the Gwassi Hills in November 2014. It is probably resident in small numbers and overlooked in suitable habitat.

Little Rock Thrush *Monticola rufocinereus*

An adult was photographed atop a dilapidated building near the summit of the Gembe Hills in February 2012. It may have been a wandering individual but it seems equally possible that the species may be a resident here, breeding sparingly on buildings and cliffs.

White-eyed Slaty Flycatcher *Melaeornis fischeri*

Small numbers appear to be resident, being regularly encountered in wooded agriculture and forest edge above 1800 m.

Green-headed Sunbird *Cyanomitra verticalis*

A pair was seen several times at Mwing'ore in November 2014, with the male singing aggressively. It is presumably uncommon and possibly local to certain areas within the GHFR.

Olive Sunbird *Cyanomitra olivacea*

A single bird was heard singing briefly at Kumuruga in February 2012 and another can be heard in a recording made at Magama in November 2014. For a highly vocal species, readily found in many western Kenyan forests, our low number of detections suggests it is rare in the GHFR.

Northern Double-collared Sunbird *Cinnyris reichenowi*

Common and probably resident throughout the GHFR in secondary growth and forest edge habitats above 1800 m. Vigorous territorial behaviour and counter-singing was evident in January 2011, with birds less obtrusive at other times. [XC73426, XC205788]

Black-billed Weaver *Ploceus melanogaster*

Singles and pairs were observed sparingly but widely from 1850 to 2050 m, mostly low down in dense secondary growth, but also in the sub-canopy of tall trees at the forest edge. It would appear to be uncommon here, but is probably resident.

Yellow Bishop *Euplectes capensis*

Single males were seen several times in both the Gwassi and Gembe Hills, in cultivation, moist bush and secondary growth from 1400 to 1950 m. Birds were in bright alternate plumage in January and February, but in drab basic plumage in November. It is probably a resident breeder in small numbers across the volcano.

Yellow-bellied Waxbill *Coccygia quartinia*

Singles were seen on three occasions in shrubby secondary growth at 1850 to 1950 m, twice near a stream. Birds reported from the nearby Lambwe Valley (R. Bishop pers. comm.) may well have been wanderers from the GHFR, where it is probably resident in small numbers.

Black-crowned Waxbill *Estrilda nonnula*

A pair flushed from rank cultivation at 1900 m in November 2014. It is probably resident in small numbers and may occur within the forest reserve.

Long-billed Pipit *Anthus similis*

Several birds were seen at 1500 m on rocky slopes in the Gembe Hills in February 2012, and an audio-recording was made. They were noteworthy in having a dark coloration overall, were very boldly marked on the back and breast, and had an atypically slow and disjointed song. It is presumably an overlooked resident in suitable habitat, which should be studied further and sought in the Gwassi foothills as well. [XC209314]

Western Citril *Crithagra frontalis*

While the taxonomy of the citrils has been a contentious issue, we follow Turner & Pearson (2015) and others here, who tentatively support recognition of central Kenyan *C. citrinelloides kikuyuensis* as specifically distinct from this form. "Black-faced" citrils observed in forest edge and cultivated land above 1600 m on all three visits, were photographed in November 2014 (Fig. 7) and identified as this species. In all respects the males appear the same as African Citril *C. citrinelloides kikuyuensis* apart from a contrasting brighter yellow supercilium, which wraps around the forehead separating the bill from the darker streaked crown on male birds. The population here appears to be resident, and this record has been confirmed as a first documented occurrence of this species in Kenya (D. Turner pers. comm.). The nearest reports to the Gwassi Hills are from the Kampala area in Uganda (eBird 1991), approximately 180 km to the northwest. However, we suggest that citrils along the Uganda border from the Winam Gulf north to Mt Elgon be closely scrutinized, as this species may also occur locally in that area. [XC246641]

[Some very recent photographs appear to show male citrils with the head plumage pattern of *frontalis* among typical *kikuyuensis* in Nairobi. The former may well have been widely overlooked in central as well as western Kenya, and if the two do indeed co-exist this will have implications for the African citril taxonomic debate. Ed.]



Figure 7. Male Western Citrils *Crithagra frontalis* photographed in the Gwassi Hills in November 2014, showing the distinctive and contrasting yellow supercilium and forehead.

Cinnamon-breasted Bunting *Emberiza tahapisi*

Three or more males were observed in the Gembe Hills in February 2012, countersinging from scrubby and rocky slopes at 1400 to 1500 m. It is probably an overlooked resident here in suitable habitat.

Provisional and unconfirmed species

During the course of our surveys, the presence of several additional species was suggested by insufficiently conclusive field observations, or vocalizations recorded by automated units. In the interests of completeness, and to suggest that future observers be alert for the possible presence of these species, we provide details of four such cases below:

Evergreen Forest Warbler *Bradypterus lopezi*

A song heard at Mwing'ore in February 2012, was thought to be of this species, but the bird was not seen and only a poor recording was obtained. The mimicking of this species by Red-capped Robin Chat [XC205760] in the GHFR is also suggestive of its presence.

Yellow Longbill *Macrosphenus flavicans*

A bird heard at Magama and also recorded by an automated unit at Mwing'ore in November 2014, was initially thought to be Olive-green Camaroptera *Camaroptera chloronota*. However, a subsequent reappraisal of the recording suggests the song may be that of Yellow Longbill, being similar to birds in Minziro Forest in northwest Tanzania (D. Moyer pers. comm.). Supporting this identification is a brief observation of a bird fitting the description of this species at Kumuruga in February 2012. With no known records from Kenya, confirming its possible occurrence in the GHFR should be a priority for future observers. [www.xeno-canto.org/205781]

Jameson's Wattle-eye *Dyaphorophya jamesoni*

A song consisting of about ten identical piped notes, heard twice in November 2014, in the forest interior at Magama, was immediately thought to be of this species. A partial recording revealed a note frequency centred at 3.48 kHz, with a duration of 0.21 s, and a delivery rate of 0.78 notes/s; all are appropriate for this wattle-eye. However, wing-clapping was not heard between notes, as is typical for this species, and the brief views revealed only a silhouette of a small stub-tailed bird flitting through the lower midstorey. Given our limited observation, and the possibility that a *Batis* species may be involved (though we encountered none in forest habitat in the GHFR), we leave this record as unconfirmed.

Streaky Seedeater *Crithagra striolata*

None were seen, but calls heard in secondary growth and agriculture from 1850 to 2000 m were thought to be of this species. Although there are reports from the nearby Lambwe Valley (eBird 1991), we treat its occurrence here as unconfirmed pending further observations.

Conclusions

Our surveys confirm the presence of an overlooked highland bird community adjacent to the Kenyan shores of Lake Victoria. In total, we document 46 new or new post-1970 Quarter Square Degree records (Lewis & Pomeroy 1989) from the slopes of Mt Kisingiri; the most notable amongst these is the Western Citril, a new species to Kenya. In addition, we document a distinct and highly threatened assemblage of 34 forest dependent species.

However, our visits were brief, and we were able to spend only a limited time at

either the highest altitudes of the GHFR or in the larger forest fragments. It therefore seems likely that we did not detect all species present and we are confident that further work will reveal numerous additional records. Of particular note was our failure to detect any western forest hornbills, barbets or woodpeckers; the apparent absence of an oriole may simply reflect our limited survey effort.

It is also clear that many of the extant forest specialists in the GHFR are greatly imperilled by deforestation. Present in very low numbers, and possibly forced to utilize suboptimal habitats, extinction of these genetically isolated forms in the near future is a very real possibility. Without an immediate cessation of the rampant tree felling in the GHFR, and a boost to both habitat restoration and management efforts, it seems quite possible that no forest will remain here in as little as 20 years.

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Appendix 1. Species recorded on the Gwasssi and Gembe Hills of Mount Kisingiri in January 2011, February 2012 and November 2014, including altitude, habitat use and Quarter Square Degree atlas squares for new or updated (post-1970) distributions (Lewis & Pomeroy 1986). FF=forest specialist, F=forest generalist, f=forest visitor, nf=non-forest species, GT=Globally Threatened (Birdlife International 2014), VU=Regionally Vulnerable (Bennun & Njoroge 1999), † Afrotropical Highlands Biome (Bennun & Njoroge 1999), * Recorded in the Gwasssi Hills Forest Reserve.

Species	Forest dependence	New QSD	Gwasssi Hills	Gembe Hills	Habitat use
<i>Scaly Francolin Francolinus squamatus</i>	F	60C	2030 m*		forest edge and forest interior
<i>Abdim's Stork Ciconia abdimii</i>	nf		2000 m*		overhead
<i>Hadada Ibis Bostrychia hagedash</i>	nf		1850 m		cultivation and gardens
<i>Common Kestrel Falco tinnunculus</i>	nf		2000 m*		steep terrain and cliffs
<i>Eurasian Hobby Falco subbuteo</i>	nf		2100 m*		forest edge and steep terrain
<i>Lanner Falcon Falco biarmicus</i>	nf	60A, 60C	1900–2000 m*	1800–1880 m	steep terrain and cliffs
<i>Peregrine Falcon Falco peregrinus</i>	nf	60C	1800 m		steep terrain
<i>European Honey Buzzard Pernis apivorus</i>	F		1900 m*	1800 m	forest edge and steep terrain
<i>Black Kite Milvus migrans</i>	nf		1800 m	1800 m	villages, towns and steep terrain
<i>African Harrier Hawk Polyboroides typus</i>	f		1800–2100 m*		cultivation, gardens and forest edge
<i>Ovambo Sparrowhawk Accipiter ovampensis</i>	nf	60C	2080 m*		forest edge and forest interior
<i>Common Buzzard Buteo buteo</i>	nf		1500–2100 m*		forest edge and steep terrain
<i>Augur Buzzard Buteo augur</i>	nf		1600–2100 m*	1300–1800 m	cultivation and forest edge
<i>Wahlberg's Eagle Aquila wahibergii</i>	nf		2000–2100 m*		forest edge and steep terrain
<i>Martial Eagle Polemaetus bellicosus</i> GT	nf		1900–2100 m*	1500–1800 m	grasslands and steep terrain
<i>Long-crested Eagle Lophaelus occipitalis</i>	f		1800–2150 m*		cultivation, gardens and forest edge
<i>Crowned Eagle Stephanoaetus coronatus</i> GT	FF	60C	2060–2160 m*	1850 m	forest and steep terrain
<i>Speckled Pigeon Columba guinea</i>	nf		1850 m		cultivation and gardens
<i>Lemon Dove Aptopelia larvata</i>	FF	60C	1870–2050 m*		forest interior
<i>Red-eyed Dove Streptopelia semitorquata</i>	f		1250–2100 m*		open woodland, gardens and forest edge
<i>Emerald-spotted Wood Dove Turtur chalcospilos</i>	f	60A		1450–1450 m	acacia woodland and scrub
<i>Blue-spotted Wood Dove Turtur afer</i>	f		1800–1900 m*		gardens, second growth and forest edge
<i>Tambourine Dove Turtur tympanistris</i>	F		1870–2070 m*		forest edge and forest interior
<i>African Green Pigeon Treron calvus</i>	F		1870 m*		forest edge

Species	Forest dependence	New QSD	Gwasssi Hills	Gembe Hills	Habitat use
Ross's Turaco <i>Musophaga rossae</i>	F	60C	1800–2200 m*		wooded cultivation, forest edge and forest interior
Bare-faced Go-away-bird <i>Corythaixoides personatus</i>	nf		1250 m		open woodland and bush
Red-chested Cuckoo <i>Cuculus solitarius</i>	F		2030–2100 m*		forest interior
Common Cuckoo <i>Cuculus canorus</i>	nf	60C	1880 m*		second growth and forest edge
Klaas's Cuckoo <i>Chrysococcyx klaas</i>	f		1870–2100 m*		second growth and forest edge
African Emerald Cuckoo <i>Chrysococcyx cupreus</i>	F		2040–2225 m*		forest edge and forest interior
White-browed Coucal <i>Centropus superciliosus</i>	nf		1800–2100 m*		cultivation, second growth and forest edge
Spotted Eagle Owl <i>Bubo africanus</i>	nf	60C	1800 m		cultivation and gardens
Scarce Swift <i>Schoutedenapus myioptilus</i> †	F	60C	2100–2150 m*		forest edge and steep terrain
Common Swift <i>Apus apus</i>	nf		2100 m*		steep terrain
Little Swift <i>Apus affinis</i>	nf			1850 m	steep terrain
Horus Swift <i>Apus horus</i>	nf	60C		1850 m	steep terrain
White-rumped Swift <i>Apus caffer</i>	nf			1250 m	woodland and hills
Speckled Mousebird <i>Collus striatus</i>	nf		1800–2000 m*	1450 m	bush, cultivation, gardens and second growth
Blue-naped Mousebird <i>Collus macrourus</i>	nf			1200–1350 m	acacia woodland and thicket
Narina Trogon <i>Apaloderma narina</i>	F	60C	2050–2225 m*		forest interior
Little Bee-eater <i>Merops pusillus</i>	nf		1800 m	1450 m	cultivation and bush
Cinnamon-chested Bee-eater <i>Merops oreobates</i> †	F	60C	2100 m*		forest edge and steep terrain
Eurasian Bee-eater <i>Merops apiaster</i>	f		1800 m*		cultivation and forest edge
African Grey Hornbill <i>Tockus nasutus</i>	nf			1200 m	acacia woodland and bush
Yellow-rumped Tinkerbird <i>Pogoniulus bilineatus</i>	F		1800–2225 m*		forest edge and forest interior
Red-fronted Tinkerbird <i>Pogoniulus pusillus</i>	nf		1250 m	1200–1500 m	thicket, bush and open woodland
Spot-flanked Barbet <i>Tricholaema lacymosa</i>	nf		1250–1850 m	1500 m	open woodland and gardens
White-headed Barbet <i>Lybius leucocephalus</i>	nf		1900 m*	1550 m	gardens, woodlands and forest edge
Double-toothed Barbet <i>Lybius bidentatus</i>	f		1800–1950 m*		gardens, second growth and forest edge
Least Honeyguide <i>Indicator exilis</i> VU	FF	60C	1870 m*		forest edge and forest interior
Lesser Honeyguide <i>Indicator minor</i>	f			1350 m	woodland

Species	Forest dependence	New QSD	Gwasssi Hills	Gembe Hills	Habitat use
Scaly-throated Honeyguide <i>Indicator variegatus</i>	f		2050 m*	1350 m	woodland, forest edge and forest interior
Greater Honeyguide <i>Indicator indicator</i>	f		2070 m*		forest edge
Nubian Woodpecker <i>Campethera nubica</i>	nf			1200–1400 m	acacia woodland and bush
Cardinal Woodpecker <i>Dendropicos fuscescens</i>	f		1800–2150 m*		forest edge and second growth
Chin-spot Batis <i>Batis molitor</i>	nf		1250 m		open woodland
Black-headed Batis <i>Batis minor erlangeri</i>	nf			1400 m	thicket and bush
Brown-throated Wattle-eye <i>Platysteira cyanea</i>	f		1870–2130 m*		forest edge and forest interior
Black-fronted Bushshrike <i>Chlorophoneus nigrifrons</i>	FF	60C	2080 m*		forest interior
Sulphur-breasted Bushshrike <i>Chlorophoneus sulfuriceps</i>	f		1250 m		open and bush
Brown-crowned Tchagra <i>Tchagra australis</i>	nf		1700–1950 m*	1400 m	thicket, bush and steep terrain
Black-crowned Tchagra <i>Tchagra senegalus</i>	nf		1800–1950 m		cultivation and bush
Black-backed Puffback <i>Dryoscopus cubla</i>	F		1250–2225 m*		open woodland, forest edge and forest interior
Slate-coloured Boubou <i>Laniarius funebris</i>	nf			1200–1300 m	thicket and scrub
Tropical Boubou <i>Laniarius aethiopicus</i>	f		1800–2225 m*	1450 m	thicket, gardens, forest edge and forest interior
Black-headed Gonolek <i>Laniarius erythrogaster</i>	nf		1250 m		thicket and bush
Black Cuckooshrike <i>Campephaga flava</i>	f		1850–2080 m*		second growth and forest edge
Common Fiscal <i>Lanius collaris</i>	nf		1600–2000 m*	1300–1850 m	bush, cultivation, second growth and forest edge
Common Drongo <i>Dicrurus adsimilis</i>	nf		1250 m		bush and open woodland
African Paradise Flycatcher <i>Terpsiphone viridis</i>	f		1250–2100 m*		open woodland, forest edge and forest interior
Pied Crow <i>Corvus albus</i>	nf		1750 m		towns and villages
White-bellied Tit <i>Parus albiventris</i>	f		1250–2225 m*		open woodland, forest edge and forest interior
White-headed Saw-wing <i>Psaldiprocne albiceps</i>	f		1800–2150 m*		cultivation, forest edge and steep terrain
Black Saw-wing <i>Psaldiprocne pristoptera</i>	f	60C	1900 m		cultivation and forest edge
Barn Swallow <i>Hirundo rustica</i>	nf		1800–1900 m		cultivation and open terrain
Rock Martin <i>Ptyonoprocne fuligula</i>	nf	60A, 60C	1400–2100 m*		rockfaces, cliffs and steep terrain
Common House Martin <i>Delichon urbicum</i>	nf	60C	1900 m*		cultivation, forest edge and steep terrain
Red-rumped Swallow <i>Cecropis daurica</i>	nf		1800–1900 m*		cultivation, forest edge and steep terrain

Species	Forest dependence	New QSD	Gwassii Hills	Gembe Hills	Habitat use
Flappet Lark <i>Mirafra rufocinnamomea</i>	nf			1750 m	grassland
Red-faced Cisticola <i>Cisticola erythrops</i>	nf		1800–2150 m*		cultivation, thicket and second growth
Trilling Cisticola <i>Cisticola woosnami</i>	nf		1300–1700 m	1300–1600 m	bush, scrub and grassland on steep terrain
Chubb's Cisticola <i>Cisticola chubbii</i> †	F	60C	1950 m*		cultivation and second growth
Rock-loving Cisticola <i>Cisticola emini emini</i>	nf	60A		1500 m	scrub and grassland on rocky slopes
Rattling Cisticola <i>Cisticola chiniana</i>	nf	60A		1200 m	acacia woodland and bush
Wailing Cisticola <i>Cisticola lais</i>	nf	60A		1250 m	scrub on rocky slopes
Croaking Cisticola <i>Cisticola natalensis</i>	nf	60C	1250 m	1750 m	grassland on slopes
Siffling Cisticola <i>Cisticola brachypterus</i>	nf		1800–1950 m		open woodland on slopes
Tawny-flanked Prinia <i>Prinia subflava</i>	nf		1880 m*		bush, cultivation and gardens
White-chinned Prinia <i>Schistolais leucopogon</i>	F		1870–2225 m*		streamside second growth and forest edge
Grey Apalis <i>Apalis cinerea</i>	FF	60C	1800–2150 m*		forest edge and forest interior
Grey-capped Warbler <i>Eminia lepida</i>	f		1250–2225 m*		cultivation, gardens, second growth and forest edge
Grey-backed Camaroptera <i>Camaroptera brachyura</i>	f		2050 m*		thicket, second growth and forest edge
White-browed Crombec <i>Sylvietta leucophrys</i> †	FF	60C			forest interior
Common Bulbul <i>Pycnonotus barbatus</i>	f		1250–2225 m*	1300 m	gardens, second growth and forest edge
Plain Greenbul <i>Andropadus curvirostris</i>	FF	60C	2080 m*		forest interior
Yellow-whiskered Greenbul <i>Andropadus latirostris</i>	F	60C	1870–2225 m*		forest edge and forest interior
Slender-billed Greenbul <i>Andropadus gracilirostris</i>	FF	60C	1850–2110 m*		forest edge and forest interior
Cabanis's Greenbul <i>Phyllastrephus cabanisi</i>	FF		1870–2150 m*		second growth, forest edge and forest interior
Moustached Grass Warbler <i>Melocichla mentalis</i>	nf		1700–1950 m*	1350 m	cultivation, thicket and second growth
Willow Warbler <i>Phylloscopus trochilus</i>	f		1950–2225 m*		forest edge
Red-faced Crombec <i>Sylvietta whytii</i>	nf		1250 m		open woodland and bush
Blackcap <i>Sylvia atricapilla</i>	F		1870–2225 m*		second growth and forest edge
Garden Warbler <i>Sylvia borin</i>	f		1800–2100 m*		gardens and forest edge
Arrow-marked Babbler <i>Turdoides jardineii</i>	nf	60A, 60C	1600 m	1250–1500 m	bush, thicket and gardens
African Yellow White-eye <i>Zosterops senegalensis</i>	f		1800–2225 m*		gardens, forest edge and forest interior

Species	Forest dependence	New QSD	Gwassii Hills	Gembe Hills	Habitat use
Sharpe's Starling <i>Pholia sharpii</i> †	FF	60C	1900–2200 m*		forest edge and forest interior
Red-billed Oxpecker <i>Buphagus erythrorhynchus</i>	nf			1300 m	scrub and bush near habitation
African Thrush <i>Turdus pelios</i>	f		1850 m		cultivation and gardens
Grey-winged Robin <i>Sheppardia polioptera</i> VU	FF		2030 m*		forest edge and forest interior
White-browed Robin Chat <i>Cossypha heuglini</i>	nf		1800–2050 m*		cultivation, gardens and forest edge
Red-capped Robin Chat <i>Cossypha natalensis</i>	F		1870–2140 m*		second growth, forest edge and forest interior
Brown-backed Scrub Robin <i>Cercotrichas harlaubi</i>	f	60C	2100 m*		second growth
White-browed Scrub Robin <i>Cercotrichas leucophrys</i>	nf		1250 m	1200–1400 m	open woodland, scrub and bush
Whinchat <i>Saxicola rubetra</i>	nf		1850 m		cultivation
Northern Wheatear <i>Oenanthe oenanthe</i>	nf			1850 m	grassland and rocky slopes
Familiar Chat <i>Cercomela familiaris</i>	nf		1275 m		open woodland, grassland and rocky slopes
Little Rock Thrush <i>Monticola rufocinereus</i> †	nf	60A, 60C		1850 m	buildings
White-eyed Slaty Flycatcher <i>Melaenornis fischeri</i> †	F		1800–2225 m*		gardens and forest edge
Spotted Flycatcher <i>Muscicapa striata</i>	nf		1850 m		cultivation and gardens
Collared Sunbird <i>Hedypna collaris</i>	F		1870–2110 m*		second growth and forest edge
Green-headed Sunbird <i>Cyanomitra verticalis</i>	F		1870 m*		forest edge and forest interior
Olive Sunbird <i>Cyanomitra olivacea</i>	FF	60C	2050–2110 m*		forest interior
Amethyst Sunbird <i>Chalcomitra amethystina</i>	f	60C	1800–2000 m*		cultivation, gardens, second growth and forest edge
Scarlet-chested Sunbird <i>Chalcomitra senegalensis</i>	nf		1800–2100 m*		cultivation, gardens and forest edge
Bronze Sunbird <i>Neclarinia kilimensis</i> †	f		1250–2100 m*		bush, cultivation, gardens and second growth
Northern Double-collared Sunbird <i>Cinnyris reichenowi</i> †	F	60C	1800–2225m*		second growth, forest edge and forest interior
Beautiful Sunbird <i>Cinnyris pulchellus</i>	nf			1300–1450 m	bush and thicket
Marico Sunbird <i>Cinnyris mariquensis</i>	nf		1250 m		open woodland and bush
Red-chested Sunbird <i>Cinnyris erythrocerus</i>	nf			1300 m	bush and thicket
Variable Sunbird <i>Cinnyris venustus</i>	f		1800–1900 m*		cultivation and forest edge
Copper Sunbird <i>Cinnyris cupreus</i>	f		1850 m		cultivation and gardens
White-browed Sparrow Weaver <i>Plocepasser mahali</i>	nf			1200 m	acacia woodland and bush

Species	Forest dependence	New QSD	Gwasssi Hills	Gembe Hills	Habitat use
Grey-headed Sparrow <i>Passer griseus</i>	nf		1250–1850 m		cultivation and gardens
Yellow-spotted Petronia <i>Petronia pyrgita</i>	nf		1250 m		open woodland and bush
Grosbeak Weaver <i>Amybospiza albifrons</i>	f		1900–2000 m*		second growth
Baglafaecht Weaver <i>Ploceus baglafaecht reichenowi</i> †	f		1800–2100 m*	1350–1500 m	scrub, cultivation, second growth and forest edge
Spectacled Weaver <i>Ploceus ocularis</i>	f		1800–2000 m*		cultivation, thicket and second growth
Black-billed Weaver <i>Ploceus melanogaster</i> †	FF	60C	1870–2100 m*		second growth and forest edge
Lesser Masked Weaver <i>Ploceus intermedius</i>	nf		1800 m*		scrub and thicket
Village Weaver <i>Ploceus cucullatus</i>	nf		1800–1900 m		cultivation and gardens
Golden-backed Weaver <i>Ploceus jacksoni</i>	nf		1250 m		open woodland and bush
Black-winged Red Bishop <i>Euplectes hordeaceus</i>	nf		1850 m		cultivation
Yellow Bishop <i>Euplectes capensis</i>	nf	60A, 60C	1600–1950 m*	1400 m	bush, cultivation and second growth
Yellow-bellied Waxbill <i>Coccyzygia quartinia</i>	f		1870–2000 m*		second growth and forest edge
Common Waxbill <i>Estrilda astrild</i>	nf		2050 m*		second growth
Black-crowned Waxbill <i>Estrilda nonnula</i>	f	60C	1900 m		cultivation and forest edge
Red-cheeked Cordon-bleu <i>Uraeginthus bengalus</i>	nf		1250 m		open woodland and bush
Purple Grenadier <i>Granatina ianthinogaster</i>	nf			1250–1400 m	scrub and thicket
Bronze Mannikin <i>Spermestes cucullatus</i>	nf		1250–1900 m		bush, cultivation and second growth
Pin-tailed Whydah <i>Vidua macroura</i>	nf		1250 m		open woodland and bush
African Pied Wagtail <i>Motacilla aguimp</i>	nf		1850 m		cultivation and gardens
Long-billed Pipit <i>Anthus similis</i>	nf	60A		1500 m	scrub, grassland and rocky slopes
Plain-backed Pipit <i>Anthus leucophrys</i>	nf		1250 m		bush and grassy slopes
Tree Pipit <i>Anthus trivialis</i>	f		1250–2060 m*		open woodland, second growth and forest edge
Western Citril <i>Crithagra frontalis</i>	f	60C	1600–2080 m*		cultivation, gardens, second growth and forest edge
Yellow-fronted Canary <i>Crithagra mozambica</i>	nf		1250 m		bush and open woodland
White-bellied Canary <i>Crithagra dorsostrata</i>	nf			1200 m	scrub and acacia woodland
Brimstone Canary <i>Crithagra sulphurata</i>	nf		1850 m		cultivation and gardens
Cinnamon-breasted Bunting <i>Emberiza tahapisi</i>	nf	60A		1400–1500 m	scrub and rocky slopes