



ALTITUDINAL ZONATION OF THE AVIFAUNA IN MWANIHANA AND MAGOMBERA FORESTS, EASTERN TANZANIA

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INTRODUCTION

There has been considerable recent interest in the ornithology of the Mwanihana Forest in the Uzungwa Mountains, Tanzania, especially since the discovery there of a new and very distinct species of sunbird, *Nectarinia rufipennis*, in 1981 (Jensen, 1983). Collar and Stuart (1985) noted that six threatened bird species occur in Mwanihana Forest and so the area has assumed great importance for conservation. Earlier the forest received considerable publicity when a new and very isolated subspecies of the Crested Mangabey, *Cercocebus galeritus*, was discovered in 1979 (Homewood and Rodgers, 1981), and the forest is also important for a rare subspecies of the Red Colobus Monkey, *Colobus badius gordonorum*, (Rodgers and Homewood, 1982). There has also been considerable botanical interest in the forest and many rare and endemic plant species occur (J. C. Lovett, pers. comm.).

Mwanihana Forest is on the eastern escarpment of the Uzungwa Mountains, in Kilombero District, Morogoro Region, Tanzania (see Fig. 1 and 2). It has only recently attracted the attention of ornithologists and only a few visits have been documented (Stuart *et al.*, 1981 ; Stuart and Jensen, 1981 ; Jensen and Stuart, 1982 ; Jensen, 1983). In July and August 1982, FPJ and SB-J carried out a six week field-study in the forest above Sanje village. Special attention was paid to the altitudinal distribution of the forest birds and field observations were made from the forest edge at 300 m a.s.l. up to a forest-covered peak at 1800 m to the north of Sanje. Mist-netting was carried out at elevations of 400, 600, 800, 1000, 1200, 1400, 1600, 1700 and 1800 m. Further ornithological work was carried out by all three authors in September 1984, especially in the forest above 1000 m.

The lower edge of the forest at 300 m is severely degraded as a result of human activities, and few of the lowland forest bird species which might be expected to occur can now be found there. For this reason, in September 1984 it was decided to

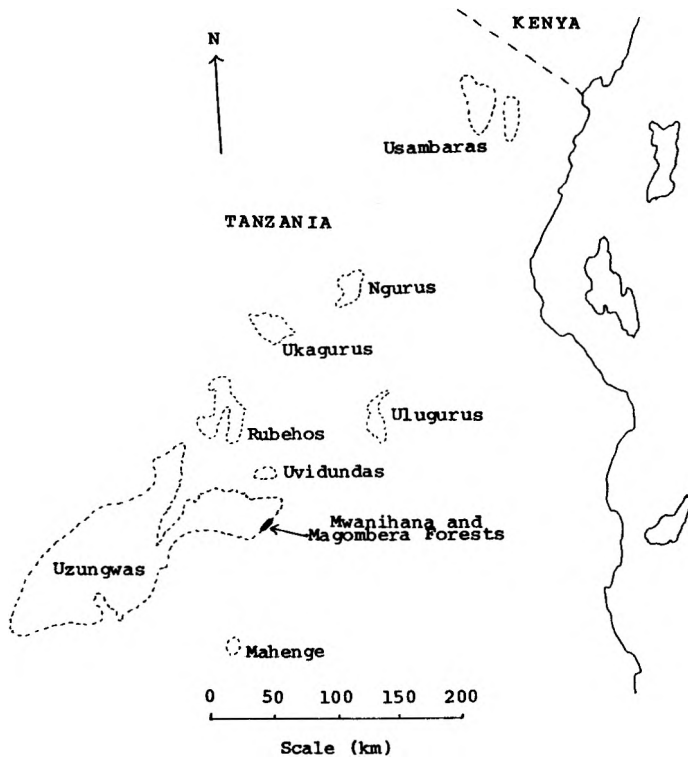


Fig. 1. Map of eastern Tanzania showing location of Mwanihana and Magombera Forests.

investigate the avifauna of the nearby Magombera Forest, also at 300 m, on the plain about 6 km east of the Uzungwa escarpment. Magombera and Mwanihana Forests were once contiguous, but became separated by the planting of the Kilombero Sugar Estate (Rodgers and Homewood, 1982). Most of Magombera Forest is now included in the Selous Game Reserve where it is well protected ; as a result, its avifauna probably still comprises all the bird species which once occurred at the lower edge of Mwanihana Forest.

As a result of our work in Mwanihana and Magombera Forests, we have been able to make a preliminary description of the altitudinal zonation of the forest birds. It is hoped that future workers will be able to add to the information presented in this paper. Mwanihana Forest is an excellent site for the study of avian altitudinal zonation. We recommend that any ornithologist planning to visit the forest takes an altimeter and also notes the dates on which birds are recorded. Only by such methods can the details of avian altitudinal zonation and seasonal vertical movements be fully understood. In this paper we are not considering in

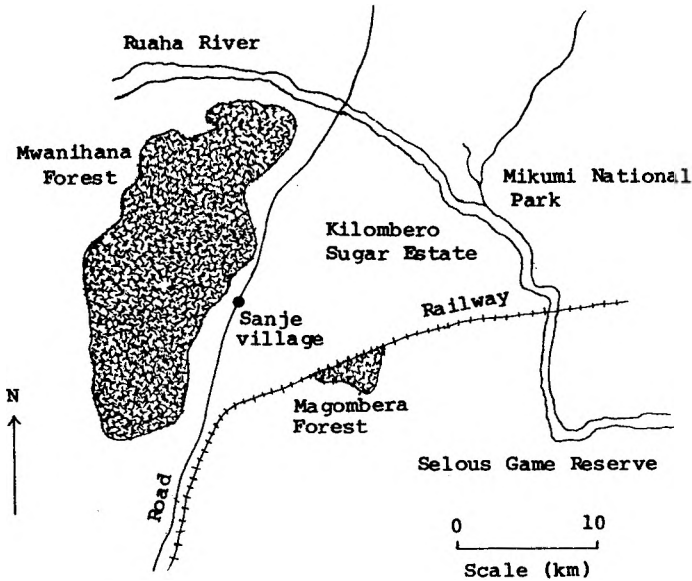


Fig. 2. Mwanihana and Magombera Forests

detail the phenomenon of seasonal altitudinal movements because data are at present insufficient. Very little ornithological work has been carried out in Mwanihana Forest outside the cold months of July to September.

This study of avian altitudinal zonation deals only with the 101 forest bird species known from Mwanihana and Magombera Forests. Non-forest species are excluded, though records of these are documented later in the paper. It is impossible to make a foolproof ecological distinction between a forest and a non-forest species (Stuart, 1983) but we have included here all forest and forest-edge birds which seem to us to be dependent upon the survival of the forest habitat. Also included are a few other birds which are clearly not forest-dependent but which live so much within the forest (amongst other habitats) that they must be considered important components of the forest bird community. The authors welcome any records of forest birds from Mwanihana and Magombera Forests, and from elsewhere in the Uzungwa Mountains, in order to build up a more complete picture of the avifauna (please send all such records to FPJ).

In this paper we follow the taxonomy and sequence of Britton (1980) except in the following instances. We use the name *Buteo oreophilus* for the Mountain Buzzard, the name *tachardus* being pre-occupied (James and Wattel, 1983). Following Dowsett and Dowsett-Lemaire (1980) we treat *Turdus abyssinicus* as a race of *T. olivaceus*, *Apalis chapini* as a species distinct from *A. porphyrolaema*, *Bradypterus mariae* as a species distinct from *B. barratti*, *Batis mixta* as a race of *B. capensis*, and we place the White-tailed Crested Flycatcher in the genus *Elminia* rather than *Trochocercus*. We follow Franzmann (1983) by treating *Ploceus nicolli* as a species distinct from *P. olivaceiceps*. The exact locations of all the localities mentioned are given in the gazetteer in Britton (1980), with a very few exceptions, for which details are given appropriately in the text.

ALTITUDINAL DISTRIBUTION

The altitudinal distribution of the avifauna in Mwanihana and Magombera Forests, as presently known, is documented in Table 1. It should be noted that Table 1 summarises the data from all our visits to Mwanihana and Magombera Forests. Our present state of knowledge is still, however, very incomplete and certain altitudes have been more intensively studied than others. Our camps were located at 300, 1000 and 1600 m and consequently the avifaunas at these elevations were the most thoroughly investigated.

We consider that the data presented here are not sufficiently complete to be worthy of detailed statistical analysis. Before such an analysis can be performed, it is necessary to carry out more detailed surveys on the altitudinal distributions of many of the rarer species, and to do more work during the hotter time of year so that seasonal vertical movements can be detected and assessed. Such a study has already been carried out in the Usambara Mountains (Stuart, 1983), but data of comparable quality from elsewhere in eastern Tanzania are not yet available.

Nevertheless, two general points can be made, both of which are suggestive of a distribution pattern similar to that found in the Usambaras. Firstly, most of the montane species occur at much lower levels than is normally the case through most of their ranges. Many occur below 800 m and some are found as low as 300 m, at least during the cold season. Secondly, only a few species seem to be restricted to a narrow band at an intermediate elevation, examples being Swynnerton's Forest-robin, *Swynnertonia swynnertonii*, the White-winged Apalis, *Apalis chariessa*, and the Banded Green Sunbird, *Anthreptes rubritorques*. There is a very wide overlap zone between lowland and montane species and it is difficult at this stage to pinpoint any critical altitudinal belts within which the avifauna changes more rapidly, though a statistical analysis of more complete data might reveal some different results.

Table 1. The altitudinal distribution of birds in Mwanihana and Magombera Forest.
(Mg = species recorded in Magombera ; Mw = species recorded in Mwanihana ; x = species presence confirmed ; - = species presence presumed).

Species	Altitude (m x 100)																	
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
Southern Banded Snake-eagle, <i>Circaetus fasciolatus</i> , Mg Mw	x	-	-	-	-	-	-	-	x									
Great Sparrowhawk, <i>Accipiter melanoleucus</i> , Mw	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x x		
Little Sparrowhawk, <i>Accipiter minullus</i> , Mg Mw	x																	
African Goshawk, <i>Accipiter tachiro</i> , Mg Mw	x	-	-	-	-	x	-	x	-	-	-	x	-	-	x	x		
Mountain Buzzard, <i>Buteo oreophilus</i> , Mw												x	-	x	x	x		
Ayres's Hawk-eagle, <i>Hieraetus dubius</i> , Mg Mw	x	-	-	-	-	-	-	x	-	x								
Crowned Eagle, <i>Stephanoetus coronatus</i> , Mg Mw	x	x	-	-	-	x	-	x	-	-	x	x	x	x	x	x		
Cuckoo Hawk, <i>Aviceda cuculoides</i> , Mw	x																	
Crested Guineafowl, <i>Guttera edouardi</i> , Mg Mw	x	-	-	x	x	x	-	x	-	-	x	x						
Lemon Dove, <i>Aplopelia larvata</i> , Mg Mw	x	-	-	x	-	x	-	-	-	x	x	-	x	x	x	x		
Olive Pigeon, <i>Columba arquatrix</i> , Mw		x	-	-	-	-	x	-	-	-	x	-	-	x	x	x		
Bronze-naped Pigeon, <i>Columba delegorguei</i> , Mw						x	-	-	x	x	x	x	x	x	x	x		
Tambourine Dove, <i>Turtur tympanistria</i> , Mg Mw	x	-	-	x	x	x	-	x	x	x	x	x	x	x	x			
Green Pigeon, <i>Treron australis</i> , Mg Mw	x	x																
Brown-necked Parrot, <i>Poicephalus robustus</i> , Mg	x																	
Livingstone's Turaco, <i>Tauraco livingstonii</i> , Mg Mw	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x		
Barred Long-tailed Cuckoo, <i>Cercococyx montanus</i> , Mw									x	x	x	x	x					

Species	Altitude (m x 100)																			
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18				
Lead-coloured Flycatcher, <i>Myioparus plumbeus</i> , Mg Mw	x	x	-	-	-	-	x	x	-	-	-	x								
Forest Batis, <i>Batis capensis</i> , Mw	-	-	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x			
Black-and-white Flycatcher, <i>Bias musicus</i> , Mg Mw	x	x	x	x	x	-	-	-	-	-	x									
White-tailed Crested Flycatcher, <i>Elminia albonotata</i> , Mw					x	x	x	-	x	x	x	x	x	x	x	x	x			
Livingstone's Flycatcher, <i>Erythrocerus livingstonei</i> , Mw	-	-	-	x																
Paradise Flycatcher <i>Terpsiphone viridis</i> , Mg Mw	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	-	-	x		
Crested Flycatcher, <i>Trochocercus cyanomelas</i> , Mg Mw	x	x	-	-	x	x	x	x	x											
Black-backed Puffback, <i>Dryoscopus cubla</i> , Mg Mw	x	-	-	x	x	x	x	x	-	-	-	x	x							
Fulleborn's Black Boubou, <i>Laniarius fuelleborni</i> , Mw												x	x	x	x	x	x			
Black-fronted Bush-shrike, <i>Malaconotus multicolor</i> , Mg Mw	x	-	-	x	x	x	-	x	-	x	-	x	x	x	x	x	x			
Retz's Hemlet-shrike, <i>Prionops retzii</i> , Mg Mw	x	x																		
Chestnut-fronted Helmet-shrike, <i>Prionops scopifrons</i> , Mg	x																			
Slender-billed Chestnut-winged Starling, <i>Onychognathus tenuirostris</i> , Mw			x	-	-	-	-	-	-	-	-	x	-	-	x	x				
Waller's Chestnut-winged Starling, <i>Onychognathus walleri</i> , Mw									x	x	x	x	x	x	x	x	x			
Kenrick's Starling <i>Poeyoptera kenricki</i> , Mw												-	-	-	x	-	-			
Collared Sunbird, <i>Anthreptes collaris</i> , Mg Mw	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
Uluguru Violet-backed Sunbird, <i>Anthreptes neglectus</i> , Mg Mw	x	x	x	x	x	x	x	x	x	x	x									
Banded Green Sunbird <i>Anthreptes rubritorques</i> , Mw							x	-	x											
Moreau's Sunbird, <i>Nectarinia moreaui</i> , Mw																	x	x	x	x

Species	Altitude (m x 100)																	
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
Olive Sunbird, <i>Nectarinia olivacea</i> , Mg Mw	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Rufous-winged Sunbird, <i>Nectarinia rufipennis</i> , Mg Mw				x	x	x	-	x	x	x	x	x	x	x	x			
Yellow White-eye, <i>Zosterops senegalensis</i> , Mw						x	-	-	x	-	-	-	x	x	x	x		
Dark-backed Weaver, <i>Ploceus bicolor</i> , Mg Mw	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Usambara Weaver, <i>Ploceus nicolli</i> , Mw										x	x	x	x	-	x	x		
Red-faced Crimson-wing, <i>Cryptospiza reichenovii</i> , Mw								x	x	-	x	x	x	x	x	x		
Peter's Twinspot, <i>Hypargos niveoguttata</i> , Mg	x																	
Green-backed Twinspot, <i>Mandingoa nitidula</i> , Mw	-	-	-	-	-	-	-	-	x									

RECORDS OF NON-FOREST SPECIES

The following non-forest species have been recorded in the vicinity of Mwanihana and Magombera Forests, mainly in forest clearings. In each case altitudes are given and the codes Mg and Mw refer to the species being recorded from Magombera and Mwanihana Forests respectively.

Long-tailed Cormorant, *Phalacrocorax africanus* 300 Mg
 Darter, *Anhinga rufa*, 300 m Mg
 Purple Heron, *Ardea purpurea*, 300 m Mg
 Squacco Heron, *Ardeola ralloides*, 300 m Mg
 Green-backed Heron, *Butorides striatus*, 300 m Mg
 Yellow-billed Egret, *Egretta intermedia*, 300 m Mg
 Hamerkop, *Scopus umbretta*, 300 m Mg
 Woolly-necked Stork, *Ciconia episcopus*, 300 m Mg
 Marabou, *Leptoptilos crumeniferus*, 300 m Mg
 Yellow-billed Stork, *Mycteria ibis*, 300 m Mg
 Hadada Ibis, *Bostrychia hagedash*, 300 m Mg
 Palmnut Vulture, *Gypohierax angolensis*, 300-800 m Mg Mw
 Hooded Vulture, *Neophron monachus*, 300 m Mg
 Harrier-hawk, *Polyboroides radiatus*, 300-1800 m Mg Mw

- Shikra, *Accipiter badius*, 600-800 m Mw
Fish Eagle, *Haliaeetus vocifer*, 300 m Mg
Black Kite, *Milvus migrans*, 300 m Mg
Bat Hawk, *Macheiramphus alcinus*, 300 m Mg
Dickinson's Kestrel, *Falco dickinsoni*, 300 m Mg
Peregrine Falcon, *F. peregrinus*, 1800 m Mw
Black Crake, *Limnocorax flavirostra*, 300 m Mg
Jacana, *Actophilornis africanus*, 300 m Mg
Green Sandpiper, *Tringa ochropus*, 300 m Mg
Red-eyed Dove, *Streptopelia semitorquata*, 300 m Mg
Blue-spotted Wood-dove, *Turtur afer*, 300 m Mg
Violet-crested Turaco, *Tauraco porphyreolophus*, 300 m Mg
Klaas's Cuckoo, *Chrysococcyx klaas*, 300-1300 m Mw
White-browed Coucal, *Centropus superciliosus*, 300 m Mg
Scarce Swift, *Schoutedenapus myoptilus*, 1000-1800 m Mw
Giant Kingfisher, *Ceryle maxima*, 400 m Mw
Pied Kingfisher, *C. rudis*, 300 m Mg
Malachite Kingfisher, *Alcedo cristata*, 300 m Mg
Half-collared Kingfisher, *A. quadribrachys*, 400 m Mw
Brown-hooded Kingfisher, *Halcyon albiventris*, 300 m Mg
Striped Kingfisher, *H. chelicuti*, 300 m Mg
Little Bee-eater, *Merops pusillus*, 300 m Mg
Hoopoe, *Upupa epops*, 800 m Mw
Striped Swallow, *Hirundo abyssinica*, 300 m Mg
Wire-tailed Swallow, *H. smithii*, 300 m Mg
White-headed Roughwing, *Psalidoprocne albiceps*, 1400 m Mw
Black Roughwing, *P. pristoptera*, 300-1800 m Mg Mw
African Golden Oriole, *Oriolus auratus*, 300 m Mg Mw
Black-headed Oriole, *O. larvatus*, 300 m Mg
White-necked Raven, *Corvus albicollis*, 300-1800 m Mw
Common Bulbul, *Pycnonotus barbatus*, 300-600 m Mg Mw
White-browed Robin-chat, *Cossypha heuglini*, 300 m Mw
Yellow-breasted Apalis, *Apalis flavida*, 300-800 m Mg Mw
Tawny-flanked Prinia, *Prinia subflava*, 300 m Mg
Moustached Warbler, *Sphenoeacus mentalis*, 300 m Mg
East Coast Batis, *Batis soror*, 600 m Mw
Black-throated Wattle-eye, *Platysteira peltata*, 600-800 m Mw
Mountain Wagtail, *Motacilla clara*, 300-1400 m Mw
Tropical Boubou, *Laniarius ferrugineus*, 300-400 m Mg Mw
Grey-headed Bush-shrike, *Malaconotus blanchoti*, 300 m Mg
Crested Helmet-shrike, *Prionops plumata*, 300 m Mg
Red-winged Starling, *Onychognathus morio*, 400, 1500-1800 m Mw
Amethyst Sunbird, *Nectarinia amethystina*, 300 m Mg
Little Purple-banded Sunbird, *N. bifasciata*, 300 m Mg
Scarlet-chested Sunbird, *N. senegalensis*, 300 m Mg
Grosbeak Weaver, *Amblyospiza albifrons*, 300 m Mg

Spectacled Weaver, *Ploceus ocularis*, 300 m Mg
 Waxbill, *Estrilda astrild*, 300 m Mg
 Lavender Waxbill, *E. perreini*, 300 m Mg
 African Firefinch, *Lagonosticta rubricata*, 300 m Mg
 Rufous-backed Mannikin, *Lonchura bicolor*, 300-1100 m Mg Mw
 Bronze Mannikin, *L. cucullata*, 300 m Mg.

NOTES ON SELECTED SPECIES

African Goshawk, *Accipiter tachiro*. - Records of the Ovampo Sparrowhawk, *Accipiter ovampensis*, from Mwanihana Forest (see Stuart and Jensen, 1981) were in fact misidentified *A. tachiro*. We thank N. E. Baker for pointing out our error.

Crested Guineafowl, *Guttera edouardi*. - Flocks of up to 30 individuals have been seen on several occasions in the forest between 600 and 800 m, with a few other records down to 300 and up to 1400 m. Records of the Kenya Crested Guineafowl, *Guttera pucherani*, from Mwanihana Forest, mentioned in Stuart *et al.* (1981) and Stuart and Jensen (1981), were of misidentified *G. edouardi*.

Lemon Dove, *Aplopelia larvata*. - One was netted at 300 m in Magombera Forest on 14 September 1984. This record is possibly indicative of seasonal movements to lower altitudes outside the breeding season (see Stuart and Jensen, 1981).

Olive Pigeon, *Columba arquatrix*. - The very low altitude records at 400 m (during the cold season) might reflect seasonal vertical movements, as suggested for the previous species. However, these records could also be explained by birds occasionally moving to low elevations when certain species of tree are in fruit.

Barred Long-tailed Cuckoo, *Cercococcyx montanus*. - This cuckoo was recorded as common in the forest between 1000 and 1500 m in January 1981, when its distinctive call made it easy to register. However, on subsequent visits, all between July and September, it was not recorded at all. It is a very elusive species and when not calling it is easily overlooked. It is not clear, therefore, whether these cuckoos were present in the forest during our more recent visits, or whether they move to lower altitudes in the coastal plain during the cool, non-breeding season. There are several records of this species from lowland forests and bushland in both Kenya and Tanzania (Britton, 1977, 1978, 1981; Stuart and Jensen, 1985) and these probably at least partially involve wanderers or migrants, but any such movements are still poorly understood.

Scarce Swift, *Schoutedenapus myoptilus*. - Small flocks were observed a few times high above the forest at 1000 and 1800 m in July and August 1982, these

records constituting the first records of the species from the Uzungwa Mountains.

Mottle-throated Spinetail, *Telacanthura ussheri*. - Flocks of between 25 and 50 birds were seen several times in July and August 1982 foraging low over the forest at 1400 and 1500 m, especially in the late afternoons. These are the first records from the Uzungwa Mountains. The species was recorded at Magombera Forest in September 1984.

White-eared Barbet, *Buccanodon leucotis*. - This barbet is common at the forest edge at 400 m, and also occurs in Magombera Forest. At higher elevations, inside the forest, it appears to be replaced by the Green Barbet, *Buccanodon olivaceum*, which we have only recorded once as low as 400 m. The subspecies of *leucotis* in Mwanihana and Magombera Forests is *kilimense*, which is known elsewhere in Tanzania from Mount Meru, Mount Kilimanjaro, the North Pares, the Usambaras and the Pugu Hills. To the north-east and south-west of Mwanihana Forest, the distinctive subspecies, *leucogrammicum*, occurs in the foothills of the Ulugurus and at Mahenge.

Moustached Green Tinkerbird, *Pogoniulus leucomystax*. - Ripley and Heinrich (1969) described the subspecies *meridionalis* from Mdando Forest in the Livingstone Mountains. Clancey (1971) considered, however, that the variation in ventral colours which Ripley and Heinrich noted are not stable differences but rather due to specimens of different plumage age. Benson and Benson (1975) agreed with Clancey that *meridionalis* cannot be upheld on colour differences but probably instead on size. Birds from Kenya and northern Tanzania south to the Ulugurus are smaller (wing-length 52-57 mm), compared with the population in southern Tanzania and Malawi (wing-length 55-59 mm) (Benson and Benson, 1975). Two specimens collected in Mdando Forest by Th. Andersen, now in the Zoologisk Museum in Copenhagen, have wing-lengths of 59-60 mm; this supports Benson and Benson's contention that southern birds generally have longer wings. Since, however, there is a considerable overlap in these wing measurements, and there are few museum specimens from geographically intervening areas such as the Uzungwas (we have been unable to collect any specimens from Mwanihana), we prefer not to recognise *meridionalis* as a valid form.

Eastern Honeybird, *Prodotiscus zambesiae*. - This species was observed twice inside the forest at 1500 and 1600 m in August 1982. On both occasions a bird was seen in a mixed-species party and kept mainly to the canopy. The species is easily overlooked and is probably more common than these two records indicate. It is a new species for the Uzungwa Mountains, the nearest previous localities being the Usambaras and the Usungu Flats (N. E. Baker, pers. comm.).

Olive Woodpecker, *Mesopicos griseocephalus*. - This woodpecker is fairly common in the montane forest from 1400 up to at least 1800 m. Two individuals caught in mist-nets were examined and found to belong to the subspecies *kilimensis*. This form was previously thought to have its southernmost limit in the Uluguru Mountains.

Black Roughwing, *Psalidoprocne pristopectera*. - Britton (1980) recognises two races of this species in Tanzania, *massaica* in the highlands of eastern Tanzania south to the Ulugurus, and *orientalis* in south-eastern Tanzania north to Iringa. In Mwanihana and Magombera Forests, dark-winged *massaica* occur, representing an extension of the known range of this race to the south-west from the Ulugurus. The species was observed in small numbers over the forest from 300 to 1800 m. At 300 m large numbers were observed feeding over cultivated land in the evenings. The altitudinal range at Mwanihana and Magombera is very different from the 1600 to 3200 m given by Britton (1980). In the Ulugurus *massaica* occurs from 300 to at least 2000 m (Stuart and Jensen, 1985) and the altitudinal limits of the species are also similar in the Usambaras (SNS, pers. obs.).

Yellow-streaked Greenbul, *Phyllastrephus flavostriatus*. - The endemic, yellow-bellied subspecies of this greenbul, *uzungwensis* (Jensen and Stuart, 1982), is very common in Mwanihana Forest from 400 m up to at least 1800 m. Above 1000 m it is abundant in both mixed-species parties and in single-species flocks of five to ten birds. This species is much more common, and has a wider altitudinal distribution, in Mwanihana Forest than in the Usambaras and Ulugurus. In Magombera Forest the widespread subspecies, *tenuirostris*, occurs. Clearly more work is needed to delimit the distribution of *uzungwensis*. So far, no intergrades between *uzungwensis* and *tenuirostris* have been found, though they can be expected to occur at the foot of the Uzungwa escarpment.

White-chested Alethe, *Alethe fuelleborni*, White-starred Forest-robin, *Pogonochla stellata*, and Orange Ground-thrush, *Turdus gurneyi*. - These montane species have been found at very low altitudes during the cold season, including records of all of them from Magombera Forest in September 1984. These records are suggestive of movements to lower elevations outside the breeding season (see Stuart and Jensen, 1981).

Dappled Mountain-robin, *Modulatrix orostruthus*. - Three individuals of the newly described subspecies, *sanjei* (Jensen and Stuart, 1982) have now been recorded from Mwanihana Forest. All were caught in mist-nets in mature rainforest, close to the ground, the type-specimen at 1250 m and the others at 1400 and 1600 m. This very rare species is only known from two other localities, at 1450 m on Namuli Mountain in northern Mozambique (Vincent, 1933) and at Amani at 900 m in the East Usambaras (Sclater and Moreau, 1935).

Stuart (1981a) has suggested that competition with the Spot-throat, *Modulatrix stictigula*, and the Pale-breasted Illadopsis, *Trichastoma rufipennis*, might be an explanation for the relict, disjunct range of *orostruthus*. In Mwanihana Forest *T. rufipennis*, appears to be absent and *M. orostruthus* and *stictigula* overlap between 1400 and 1600 m. *Modulatrix orostruthus* is a low-density species in Mwanihana Forest, whereas *stictigula* is common, even in areas of sympatry with *orostruthus*. This is different from the situation in the Usambaras where both species are uncommon in the zone of sympatry around 900 m (Stuart, 1981a).

Swynnerton's Forest-robin, *Swynnertonia swynnertoni*. - The recently described subspecies, *rodgersi*, (Jensen and Stuart, 1982) is a rare bird with a very limi-

ted altitudinal range. Five birds have been mist-netted, two at 1000 m and three at 1200 m. Stuart and Jensen (1981) give an altitude of 100 m, a typographic error for 1000 m. The eastern highlands of Zimbabwe and adjacent areas in Mozambique are the only other known localities (Irwin, 1981). This species is restricted to the ground-stratum of the forest and most individuals have been caught very low in the mist-nets. One bird that was observed feeding on the ground among dry leaves was later caught in one of the nets ; it jumped rather than flew into it.

White-winged Apalis, *Apalis chariessa*. - This species is moderately common at intermediate elevations, usually seen in pairs in mixed-species parties. Although seen occasionally in the lower mid-stratum of the forest, most records have been of birds high in the canopy of large-crowned trees.

Mrs Moreau's Warbler, *Bathmocercus winifredae*. - This warbler occurs in small numbers from 1300 to 1600 m, always in very dense vegetation near the ground. This is only the third locality for this species, otherwise known from the Ukagurus and Ulugurus.

Kretschmer's Longbill, *Macrosphenus kretschmeri*. - This usually local species is much more common in Mwanihana and Magombera Forests than in the Usambaras and Ulugurus. It is an elusive bird of dense, mid-stratum tangles, living singly or in pairs, and would be almost impossible to detect were it not for its loud, harsh « eet-i-reed » call. It has a wide altitudinal distribution.

Slender-billed Chestnut-winged Starling, *Onychognathus tenuirostris*. - This starling, which is usually found in highland areas above 1400 m (Britton, 1980), was seen a few times between 1300 and 1700 m above the forest, and a flock was also observed as low as 400 m. The species nests and often roosts in colonies behind waterfalls (Britton, 1980). The large waterfall at 400-700 m on the Sanje River no doubt attracts the starlings to this very low altitude.

Banded Green Sunbird, *Anthreptes rubritorques*. - A flock of these sunbirds was seen once in the canopy at 1000 m in July 1982, and a single bird was seen at 850 m in September 1984. This is a new locality for this species, known previously only from the Usambaras, Ngurus and Ulugurus.

Moreau's Sunbird, *Nectarinia moreaui*. - This species, endemic to the highlands of eastern Tanzania, was previously known only from the Ngurus, Ukagurus, Kiboriani Mountain (west of the Ukagurus : specimens in British Museum (Natural History)), and the Uvidundas. It is also common, however, in the montane parts of Mwanihana Forest from 1500 up to at least 1800 m. Stuart and van der Willigen (1980) have suggested that *N. moreaui* is a hybrid species between the widespread Eastern Double-collared Sunbird, *N. mediocris*, and Loveridge's Sunbird, *N. loveridgei*, which is endemic to the Uluguru Mountains. This theory is supported by the discovery of *moreaui* in Mwanihana Forest between populations of *loveridgei* and *mediocris*. The range of *moreaui* in the Uzungwa Mountains must be very limited since *mediocris* has been found on Luhombero Mountain only 30 km to the west (R. J. Stjernstedt and D. C. Moyer, pers. comm.), and at Kilanga, the type-locality of *N. mediocris fuelleborni*, 90 km to the south-west.

Rufous-winged Sunbird, *Nectarinia rufipennis*. - This newly discovered species (Jensen, 1983) is known only from Mwanihana Forest. It is found mainly in mature forest from 1000 to 1700 m. One bird was observed, however, at 800 m in disturbed forest, and several individuals were observed feeding on flowers in a small glade at only 600 m in August 1982 (E. M. Boswell, *in litt.*).

Nectarinia rufipennis feeds on a wide range of flowering trees and shrubs, mostly between 2 and 8 m from the ground, but occasionally as high as 30 m. Most observations were of single birds but pairs foraging together were frequently seen. The species has never been noted as a member of a mixed-species party, unlike *N. moreaui*.

Nectarinia rufipennis is a very vocal species and several different calls have been noted. A loud and energetic « chirp », not unlike the voice of the House Sparrow, *Passer domesticus*, is the most common call of both sexes and a thin « see-it » can be heard while the birds forage among flowers. In flight it often utters a short « drep-drep ». The males sing a short, high pitched trilling song, often accompanied by loud, high-pitched « chirping » from the females. The birds were heard most often in the early morning and late evening.

Although this species was observed regularly above 1000 m, we found it to be most numerous between 1500 and 1700 m. At this altitude *N. moreaui* was also common and both species were frequently seen feeding on the same flowering shrubs, and often chased each other. The only other sunbirds recorded at this altitude were the Collared Sunbird, *Anthreptes collaris*, and the Olive Sunbird, *Nectarinia olivacea*, but both were rare. *Nectarinia moreaui* and *N. rufipennis* are very similar in size and general proportions. The curvature and length of their bills are almost identical and since both species appear to be feeding opportunists, foraging on all available flowering trees, shrubs and herbs, some degree of competition might be expected. The broad altitudinal overlap where both species are common may, however, be a temporary phenomenon, reflecting a local abundance of flowers. At other times of the year, when food resources might be more evenly distributed, there might be a more pronounced altitudinal segregation between *N. rufipennis* and *N. moreaui*.

Usambara Weaver, *Ploceus nicolli*. - From field observations we assign the Mwanihana birds to the subspecies *anderseni* (see Franzmann, 1983). Single birds or pairs of this weaver were found in small numbers as members of mixed-species parties between 1100 and 1700 m. Although it is a low density species in Mwanihana Forest, it appears to be more numerous here than in the Usambaras and Ulugurus, the only other localities from which it is known.

Another species of weaver, the slightly larger but in other respects very similar Dark-backed Weaver, *P. bicolor*, has been observed in nearly every mixed-species bird party from 300 up to 1800 m. There may be some degree of overlap in the feeding behaviour of these two species, though *nicolli* is restricted to the canopy and the mid-stratum and usually keeps to the outermost twigs, whereas *bicolor* seems to be less specialised and was caught in mist-nets close to the forest floor.

THE CONCENTRATION OF ENDEMIC AND RARE SPECIES

The Usambara and Uluguru Mountains have traditionally been regarded as the centres of species richness and endemism for forest birds in eastern Tanzania (Moreau, 1966 ; Stuart, 1981b). This view now requires modification as a result of the recent exploration of Mwanihana Forest. Appendix 2 in Stuart and Jensen (1981) tabulated the distributions of the 24 endemic and near-endemic birds of the Tanganyika-Nyasa montane forests (as defined by Moreau (1966)). Following the taxonomy adopted in this paper (see Introduction), we no longer consider *Laniarius fuelleborni* to be endemic to these forests. However, we now consider *Apalis chapini* to be an endemic species, and so, with these changes, there are 13 and 15 such species in the Usambaras and Ulugurus respectively (Stuart and Jensen, (1981) gave figures of 14 and 15 species). In the Uzungwa Mountains this figure is 18 (three species, *Bathmocercus winifredae*, *Anthreptes rubritorques*, and *Nectarinia moreaui* having been found for the first time since Stuart and Jensen (1981) wrote their paper). Of these 18 species, the Olive-flanked Ground-robin, *Dryocichloides anomalus*, Iringa Ground-robin, *D. lowei*, and Red-capped Forest-warbler, *Orthotomus metopias*, have been found elsewhere in the Uzungwas but not yet at Mwanihana. Two of these three, *D. anomalus* and *O. metopias* might well be found in Mwanihana. However, *D. lowei* is probably restricted to the high altitude plateau forests of the Uzungwas and Southern Highlands, avoiding high rainfall areas such as Mwanihana Forest. Another two species, the Long-billed Apalis, *Apalis moreaui*, and Uluguru Bush-shrike, *Malaconotus alius*, which have not been recorded anywhere in the Uzungwas, could conceivably be discovered in Mwanihana. The total number of Tanganyika-Nyasa endemics so far known from Mwanihana is, therefore, 15 ; however, it is possible that 17, conceivably as many as 19, may occur.

The Uzungwa Mountains are also very important for rare and threatened species (which are not necessarily the same as Tanganyika-Nyasa endemics). For the purposes of this paper we define a rare species as one whose world distribution encompasses four major forest blocks or fewer. Table 2 depicts the distribution of the 17 such rare species occurring in the eastern East African forests (15 of these are treated as threatened by Collar and Stuart, 1985). Eight occur in the Uzungwas (seven of these in Mwanihana), seven in the Usambaras, five in the Ulugurus, four in Sokoke Forest and no more than two elsewhere. It is clear, therefore, both from the number of Tanganyika-Nyasa endemics and near-endemics, and the number of rare species, that the Uzungwa Mountains, and in particular their eastern escarpments around Mwanihana Forest, constitute the single most important site for threatened forest birds in eastern East Africa. It has been recommended that this area be set aside as a national park (Rodgers and Homewood, 1982).

Apart from the species already mentioned, a number of other local or uncommon forest birds have been recorded from Mwanihana and Magombera Forests. These include the Southern Banded Snake-eagle, *Circaetus fasciolatus*, Purple-

Table 2. The distribution of rare forest birds in eastern East Africa.

Species	Forest Areas*									
	1	2	3	4	5	6	7	8	9	10
<i>Bubo vosseleri</i> (1)		x								
<i>Otus ireneae</i>								x		
<i>Dryocichloides lowei</i>	x					x				
<i>Dryocichloides montanus</i>		x								
<i>Modulatrix orostruthus</i>	x	x					x			
<i>Swynnertonia swynnertonii</i>	x									x
<i>Apalis moreaui</i>		x					x			
<i>Bathmocercus winifredae</i>	x		x		x					
<i>Anthus sokokensis</i> (2)								x	x	
<i>Malaconotus alius</i>				x						
<i>Anthreptes pallidigaster</i>		x						x		
<i>Anthreptes rubritorques</i>	x	x	x	x						
<i>Nectarinia loveridgei</i>			x							
<i>Nectarinia moreaui</i> (3)	x			x	x					
<i>Nectarinia rufipennis</i>	x									
<i>Ploceus golandi</i>								x		
<i>Ploceus nicolli</i>	x	x	x							
TOTAL	8	7	5	2	2	1	2	4	1	1

Note :(1) We treat *Bubo vosseleri* as a species distinct from *B. poensis*, following Collar and Stuart (1985).(2) *Anthus sokokensis* has also been recorded from a small patch of forest near Moa, in north-eastern Tanzania.(3) *Nectarinia moreaui* has also been recorded from the Uvidunda Mountains, eastern Tanzania.*** Key to forest areas in Table 2 :**

- 1 Uzungwa, Tanzania
- 2 Usambara, Tanzania
- 3 Uluguru, Tanzania
- 4 Nguru, Tanzania
- 5 Ukaguru, Tanzania

- 6 Southern Highlands, Tanzania
- 7 Mountains of northern Mozambique
- 8 Soko Forest, Kenya
- 9 Pugu Hills, Tanzania
- 10 Mountains south of the Zambezi River

throated Cuckoo-shrike, *Campephaga quisqualina*, White-winged Apalis, *Apalis chariessa*, Kretschmer's Longbill, *Macrosphenus kretschmeri*, Livingstone's Flycatcher, *Erythrocerus livingstonei*, and Uluguru Violet-backed Sunbird, *An-*

threptes neglectus. Another noteworthy fact is the presence of five species of forest *Apalis* warblers, compared with only three in the Usambaras and four in the Ulugurus.

SOME DISTRIBUTIONAL PROBLEMS

WHERE ARE THE LOWLAND FOREST BIRDS ?

Despite the richness of the bird community of Mwanihana and Magombera Forests, it must be noted that ten species characteristic of the Usambara and Uluguru foothill forests have not yet been recorded. Of these, three species, the Pale-breasted Illadopsis, *Trichastoma rufipennis*, Tiny Greenbul, *Phyllastrephus debilis*, and Red-tailed Ant-thrush, *Neocossyphus rufus*, seem certainly to be absent for reasons that are not understood. The remaining seven, the Fiery-necked Nightjar, *Caprimulgus pectoralis*, Barred Owlet, *Glaucidium capense*, Pallid Honeyguide, *Indicator meliphilus*, Nicator, *Nicator chloris*, Brownbul, *Phyllastrephus terrestris*, Four-coloured Bush-shrike, *Malaconotus quadricolor*, and Lesser Seed-cracker, *Pyrenestes minor*, are usually low density species and have probably so far been overlooked.

Only four montane species, which might well be present in the higher parts of Mwanihana Forest, remain to be recorded. These are the African Hill-babbler, *Alcippe abyssinia*, Olive-flanked Ground-robin, *Dryocichloides anomalus*, Red-capped Forest-warbler, *Orthotomus metopias*, and Oriole Finch, *Linurgus olivaceus*. These might occur in the unexplored forest above 1800 m, the highest part of the Mwanihana escarpment being over 2200 m.

WHERE IS THE DIVIDING LINE BETWEEN WET AND DRY FOREST ?

It is clear that there are differences between the avifauna of the dry plateau forests of the Uzungwas (such as at Dabaga and Mufindi) and that of the wet eastern escarpment at Mwanihana. The plateau forest avifauna is impoverished, lacking many of the species present on the escarpments. There are, however, four species which have been recorded from the plateau forests but which are almost certainly absent from the eastern escarpments. These are the Iringa Ground-robin, *Dryocichloides lowei*, Mountain Yellow Warbler, *Chloropeta similis*, Eastern Double-collared Sunbird, *Nectarinia mediocris*, and Thick-billed Seed-eater, *Serinus burtoni*. As yet we have little information on how the avifauna of the wet eastern escarpments grades into that of the plateau forests. It is unlikely to be a simple dividing line. D. C. Moyer and R. J. Stjernstedt (pers. comm.) have found *Nectarinia mediocris* (a dry forest species in the Uzungwas) on Luhombero Mountain, less than 30 km from its allospecies *N. moreaui*, at Mwanihana. They also found *Sheppardia sharpei* (a wet forest species) at the same locality, but no sign of its dry forest equivalent, *Dryocichloides lowei*. The two species are sympa-

tric at Dabaga (Ripley and Heinrich, 1966), while only *lowei* occurs at Mufindi. Clearly much more work is required before the intergradation of the dry plateau and wet escarpment avian communities can be better understood.

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SUMMARY

The avifauna of the Mwanihana and Magombera Forests in Tanzania is of great interest, on account of the large number of rare and threatened species present. In this paper the altitudinal zonation of the 101 forest species is described, and although the data are not yet complete, there is shown to be a broad altitudinal overlap between lowland and montane species. As in the Usambara and Uluguru Mountains, many montane species occur, at least seasonally, at remarkably low altitudes. Notes are provided on selected species and the importance of Mwanihana Forest for bird conservation is emphasized. There are probably several more lowland forest species yet to be found in Magombera Forest, and possibly a small number of montane species at the highest elevations on the Mwanihana escarpment. The forest avifauna of Mwanihana is very different from that found in the dry forest on the Uzungwa plateau, but the nature of the intergradation of the bird communities of the escarpment and plateau forests is not yet understood.

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SAMENVATTING

Omwille van het grote aantal zeldzame en bedreigde soorten die er voorkomen, is de avifauna van Mwanihana en Magombera Forests in Tanzania van bijzondere betekenis. In deze bijdrage wordt de hoogte zonerings van 101 woudebewonende soorten beschreven en, hoewel de gegevens nog onvolledig zijn, wordt er aangetoond dat er een ruime overlapping is inzake de aanwezigheid van laagland- en bergsoorten. Zoals in de Usambara en Uluguru Mountains, komen vele soorten van het gebergte, althans tijdelijk, voor op zeer geringe hoogte. Gegevens over een beperkt aantal soorten worden besproken en de nadruk wordt gelegd op het belang van Mwanihana Forest voor de vogelbescherming. Waarschijnlijk blijven er nog verschillende bosbewonende soorten van het laagland te ontdekken in Magombera Forest en misschien nog een klein aantal bergbewonende soorten op de hoogste toppen van het Mwanihana gebergte. De bosbewonende avifauna van Mwanihana verschilt erg van deze van de droge wouden van het Uzungwa-plateau, maar de aard van de wisselwerking tussen de vogelgemeenschappen van de wouden van het gebergte en de wouden van het plateau is nog onbekend.

RESUME

L'avifaune des forêts de Mwanihana et de Magombera en Tanzanie est d'un grand intérêt, en raison de la présence d'un grand nombre d'espèces rares et menacées. Dans cet article, la répartition altitudinale de 101 espèces forestières est décrite et, quoique les données soient encore incomplètes, il est démontré qu'il existe un large recouvrement altitudinal (overlap) entre les espèces de plaine et de montagne. Comme c'est également le cas dans les montagnes de Usambara et de Uluguru, beaucoup d'espèces de montagne apparaissent suivant les saisons, à des altitudes très basses. Une série de données est fournie sur certaines espèces et l'importance de la forêt de Mwanihana pour la conservation des oiseaux est démontrée. Il reste encore probablement plusieurs espèces de forêt de basse altitude à découvrir dans la forêt de Magombera et peut-être aussi un petit nombre d'espèces de haute montagne sur les hauteurs de Mwanihana. L'avifaune forestière de Mwanihana est très différente de celle trouvée dans la forêt sèche sur le plateau de Uzungwa mais la nature des interférences entre les communautés aviennes de haute montagne et celles des forêts de plateau échappe encore à l'entendement.

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