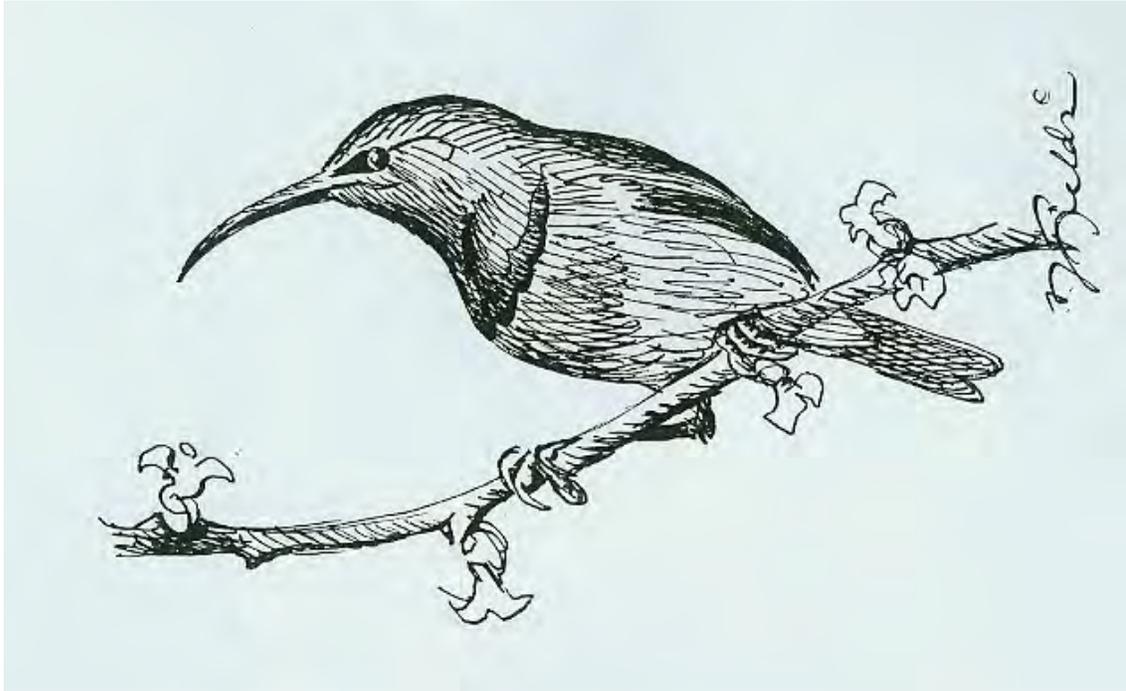


Report on The Uluguru Biodiversity Survey 1993



Part B.

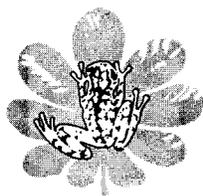
Photographs, figures, tables and appendices

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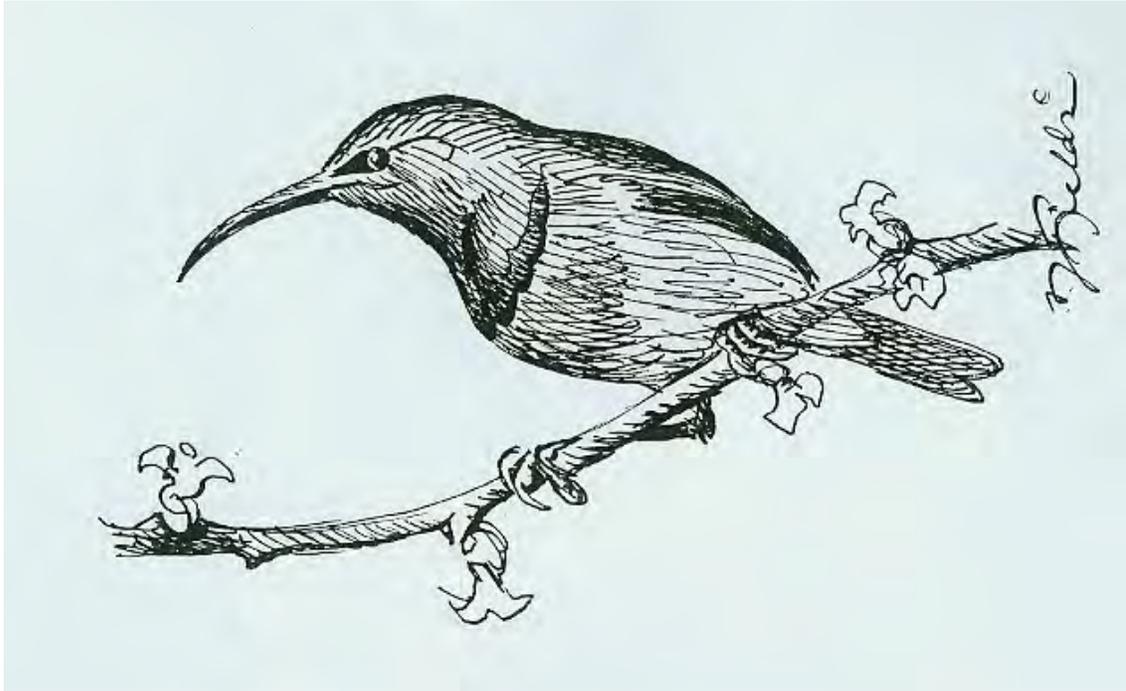
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Centre for Tropical Biodiversity



Report on The Uluguru Biodiversity Survey 1993



Part B.

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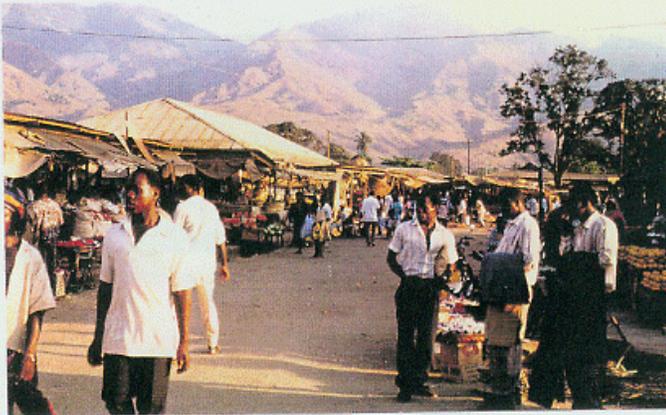


Photo 1. The market in Morogoro City with the Uluguru Mountains in the background. The forest of the Uluguru North Catchment Forest Reserve is visible on the top of the mountain peaks.



Photo 3. Disturbed but spectacular lower forest edge at Ukwama, 1550 m. In this remote SE part of the Ulugurus, human disturbance is very low shortly into the forest. Camphor trees are still common. Mammals are, however, seriously reduced in numbers by hunting.



Photo 4. Elf forest and a subalpine meadow at 2500 m altitude in the Uluguru South Catchment Forest Reserve (near our Kimhandu-5 camp). The forest up here is very impenetrable.

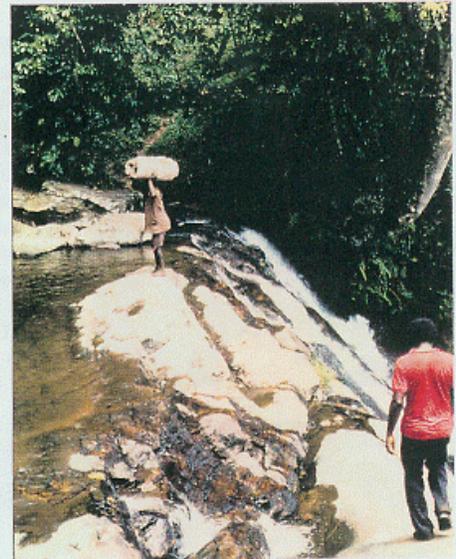


Photo 2. We reached the forests by car followed by up to seven hours of walking on the hill slopes. On the photo we are crossing one of the many streams of clean drinking water. The Uluguru forests are extremely important as water catchment area for Dar es Salaam (c. 2 million people and much industry), Morogoro City (regional centre) and local farmers.

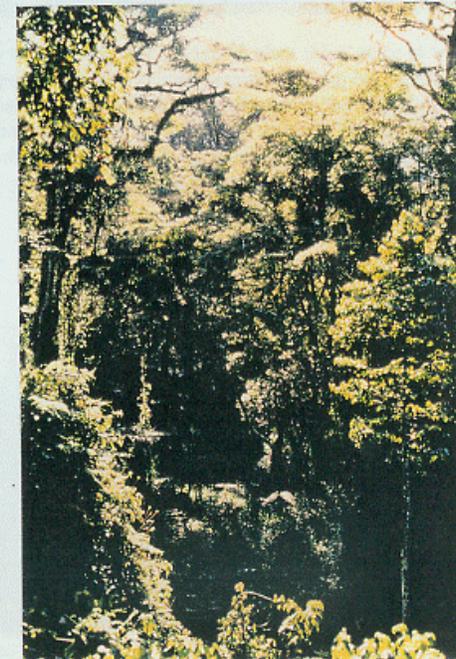


Photo 5. A characteristic habitat for Mrs Moreau's Warbler is natural big, spectacular light gaps, with dense cover of herbs in the bottom, surrounded by tall trees. This light gap is from the area near our Kimhandu-3 (1940 m) camp.



Photos 6 and 7. Mrs Moreau's Warbler (left; listed as Threatened by BirdLife/IUCN) and Loveridge's Sunbird (Near-threatened). In addition to their high water catchment value the Ulugurus are among the most important forested areas for biodiversity conservation in Africa, as they hold many animal and plant species found nowhere else (e.g. two species of mammals, two species of birds, six species of reptiles, five species of amphibians) as well as many Eastern Arc endemics and several other species listed as Threatened by IUCN.



Photos 8 and 9: In most parts of the Ulugurus cultivation extends right up to the lower forest edge. It often takes place at very steep slopes (up to and beyond 50°), usually without any measures taken to protect the soil against erosion. It is highly necessary to improve agricultural techniques. These photos from the remote Kimhandu area also serve to illustrate the depletion of firewood outside the forest. This is a threat to the forests unless large scale tree planting is initiated. The photo at the left is from the Ukwama village area, lower forest edge at c. 1500 m altitude. A few belts of grass have been planted to protect foot paths. The photo at the right is from the Wembela area, with a traditional round Luguru hut in the foreground.



Photo 10 (left) . In the past, large areas of forest and dense woodland have been cleared, and clearing of dense forest for new areas of farmland still takes place at a slow rate at the lower forest edges in many areas, here at Lanzi, one of our main study sites in the Uluguru South Catchment Forest Reserve. In many places the forest reserve boundaries are insufficiently demarcated. Photo 11 (right), Burning is widespread in the Uluguru Mountains and causes much damage in the woodlands, at the forest edges and in areas where vegetation regeneration is needed. The photo is from the woodlands at the base of the mountains.

Table 2.1. Efforts in the field during the 1993 survey.

	Dates (approximate, see * below).	Ornithological activities (key below).	Ornithologists (see * below).	Assessment of botanical plots.	Collection of ethnobotanical information.	Collection of millipedes.	Field observations of mammals.	Interviews with village elders (mammals, agriculture)
Kimhandu-6 (1540 m)	2-3 Oct.	2	EE-JF-LAH-HK-JK-LBP-MCR-JOS	None	CKM-BSS-SIM (information on all woody plants collected at plots plus information on other woody species encountered in the forest **	None	General observations by all participants	Brief interviews with village elders from Ukwama and Wembela villages by JNK-CKM-SIM-BSS **
Kimhandu-1 (1520 m)	Standard work 9-13 Oct. with some general field observations 26-29 Oct.	1	Mainly LAH-HK-LBP-JF, also EE-MCR-JOS	PH-CKM-SIM-BSS (one plot per station)		Collections by LLS between 1500 and 2600 m with 100 m altitudinal intervals (but not specifically at the mentioned stations)	Studies of Tree Hyrax (not at field stations, see ** below) by JNK plus general field observations by JNK and all other participants.	
Kimhandu-2 (1710 m)	4-8 Oct., little activity 8-10 & 14-18 Oct.	1	EE-JF-LAH-HK-JK-LBP-MCR-JOS	PH-CKM-SIM-BSS (one plot)				
Kimhandu-3 (1940 m)	12-18 Oct. with some activity 10-11 Oct.	1	EE-JF-JK-MCR-JOS	PH-CKM-SIM-BSS (one plot)				

	Dates (approximate, see * below).	Ornithological activities (key below).	Ornithologists (see * below).	Assessment of botanical plots.	Collection of ethnobotanical information.	Collection of millipedes.	Field observations of mammals.	Interviews with village elders (mammals, agriculture)
Kimhandu-4 (2145 m)	19-25 Oct.	1	EE-LAH-HK-LBP-MCR-JOS	PH-CKM-SIM-BSS (one plot)				
Kimhandu-5 (2520 m)	24-27 Oct.	1	EE-LBP-MCR-JOS	PH-CKM-SIM-BSS (one plot)				
Lanzi-1 (1710 m)	Main activity 1-8 Nov., little 9-10 Nov.	1	EE-LAH-HK-JK-LBP-MCR; JOS from 3 Nov.	PH-CKM-SIM-BSS (one plot)		Very few collected sporadically by other team members (LLS did not visit these localities)	General observations by other team members (JNK did not visit these localities)	Brief interview in Lanzi village by CKM-SIM-BSS **
Lanzi-2 (1920 m)	9-13 Nov.	1	LAH-HK-LBP-MCR, also JOS	PH-CKM-SIM-BSS (one plot)				
Lanzi-3 (2110 m)	11-18 Nov. Camp at 2000 m	1	EE-LBP-JOS, also LAH-HK-MCR	PH-CKM-SIM-BSS (one plot)				
Tegetero-1 (1345 m)	29 Nov.-6 Dec.	1	EE-LBP-JOS; LAH-MCR from 2 Dec.	CKM-SIM-BSS (one plot per station **)	CKM-BSS-SIM (informa. on all woody plants collected at plots and informa. on other woody species encountered in the forest **).	Very few collected sporadically by other team members as LLS did not visit Tegetero area	General observations by other team members as JNK did not visit Tegetero area	Brief interviews at Tegetero village by CKM-SIM-BSS **

	Dates (approximate, see * below).	Ornithological activities (key below).	Ornithologists (see * below).	Assessment of botanical plots.	Collection of ethnobotanical information.	Collection of millipedes.	Field observations of mammals.	Interviews with village elders (mammals, agriculture)
Tegetero-2 (1520 m)	Mainly 7-10 Dec. but with later visits by ornithologists 11-16 Dec.	1	EE-LAH-LBP-MCR-JOS					
Tegetero-3 (1710 m)	11-15 Dec.	1	EE-LAH-LBP-MCR-JOS					
Tchenezema	22-24 Oct.	5	JF-JK	None.	None.	None.		None.
Morningside	26 Sept.	4	JF					
Bunduki	28 Sept.	4	EE-JF					
Kigurunyembe	7-8 Dec. <u>1994</u>	3	JF-JK					
Kimboza	17-19 Oct. (JF, JK) 10-11 Nov. (JCL)	3	JF-JK	JCL **				

Key, footnotes.

* We often split up in two teams. Especially for the ornithology team it is extremely difficult to give exact data. The periods generally include establishing camps and putting up mistnets in the mentioned area and often also searching for camps in other areas and other logistics (new camps were found at least one day before moving the team). These activities were often quite time consuming in the difficult terrain. The team left the three main areas in two groups over two days (since we had generally only one car). Rain sometimes prohibited us from working.

** These data are presented elsewhere (ethnobotany: in Mabula *et al.* 1994 but with a summary in Section 8 of this report; botanical plots from the Tegetero area: in Mabula *et al.* 1994; interviews about agriculture: in Mabula *et al.* 1994 with some summarizing in Section 8 of this report; botanical plots from Kimboza: in a later publication; Tree Hyraxes: in a later publication).

Key, ornithology survey types (further details on intensity of fieldwork is given for the single stations in Table 5.3):

- 1 Full standard survey (mistnetting for two full days, assessments of one-hectare plots, 30 minutes tape recordings at dawn, general field observations).
- 2 Mistnetting for less than two full days, assessments of one-hectare plots and general field observations.
- 3 Mistnetting for less than two full days, general field observations.
- 4 General field observations, less than one day. Morningside less than one hour.
- 5 Assessments of one-hectare plots, general field observations.

Tables, Section 5 Ornithology

Table 5.1. Forest bird species of special conservation interest in the Tanganyika-Nyasa Montane Forest Group.

Table 5.1. Forest bird species of special conservation interest in the Tanganyika-Nyasa Montane Forest Group.	Tanganyika-Nyasa Montane Forests													Elsewhere	
	Eastern Arc Mountains							Other mountains							
	Taita	Pare S.	Usambaras (W&E)	Ngurus	Rubehos	Ukagurus	Ulugurus (N&S)	Udzungwas	Southern Highl.	N. Malawi	S. Malawi	Mt. Namuli	Mt. Chiye		Njesi Pl.
Taita Thrush <i>Turdus helleri</i> ⁸	Th														
Taita Apalis <i>Apalis fuscigularis</i> ⁸	Th														
Taita White-eye <i>Zosterops silvanus</i> ⁸	Th														
South Pare White-eye <i>Zosterops winifredae</i> ⁸		Th													
Plain-backed Sunbird <i>Anthreptes reichenowi</i>			Nt												■ ¹
Fischer's Turaco <i>Tauraco fischeri</i>			Nt												■ ¹
Usambara Eagle Owl <i>Bubo vosseleri</i> ⁸			Th												
Usambara Akalat <i>Sheppardia montana</i>			Th												
Sokoke Scops Owl <i>Otus irenae</i>			Th												■ ³
Long-billed Tailorbird <i>Orthotomus moreaui</i>			Th										Th		
East Coast Akalat <i>Sheppardia guntingi</i>			Th							Th					■ ⁴
Swynnerton's Robin <i>Swynnertonia swynnertoni</i>			Th				Th								■ ⁴
Amani Sunbird <i>Anthreptes pallidigaster</i>			Th				Th								■ ⁵
Dappled Mountain Robin <i>Arcanator orostrophus</i>			Th				Th				Th				
Tanzanian Mountain Weaver <i>Ploceus nicoli</i>			Th			Th	Th								
Kenrick's Starling <i>Poeoptera kenricki</i>		xx	xx				xx	xx	xx						■ ⁶
Uluguru Violet-backed Sunbird <i>Anthreptes neglectus</i>			Nt	Nt	Nt		Nt	Nt							■ ⁷
Banded Green Sunbird <i>Anthreptes rubritorques</i>			Th	Th			Th	Th							
Southern Banded Snake Eagle <i>Circaetus fasciolatus</i>			Nt	Nt			Nt	Nt							■ ¹
Sharpe's Akalat <i>Sheppardia sharpei</i>		xx	xx	xx	xx		xx	xx	xx	xx					
Spot-throat <i>Modulatrix stictigula</i>			xx	xx	xx	xx	xx	xx	xx ²	xx					
Red-capped Forest Warbler <i>Orthotomus moreaui</i>		xx	xx	xx	xx	xx	xx	xx	xx ²					xx	
White-chested Alethe <i>Alethe fuelleborni</i>		xx	xx	xx	xx	xx	xx	xx	xx	xx					■ ¹
Chapin's Apalis <i>Apalis chapini</i>				xx	xx	xx	xx	xx	xx	xx					
Moreau's Sunbird <i>Nectarinia moreaui</i> ⁸				Nt	Nt	Nt									■ ¹
White-winged Apalis <i>Apalis chariessa</i>							Th	Th		Th		Th			■ ⁹
Mrs Moreau's Warbler <i>Bathmocercus</i>					Th	Th	Th	Th							
Iringa Akalat <i>Sheppardia lowei</i>						Th	Th	Th							
Loveridge's Sunbird <i>Nectarinia loveridgei</i>						Nt									
Uluguru Bush Shrike <i>Malaconotus alius</i>						Th									
Udzungwa For. Partridge <i>Xenoperdix udzungwensis</i>								Th							
Rufous-winged Sunbird <i>Nectarinia rufipennis</i>								Th							
Kipengere Seed-eater <i>Serinus melanochrous</i> ⁸								Nt	Nt						
Thyolo Alethe <i>Alethe choloensis</i>										Th	Th	Th			

Table 5.1. Forest bird species of special conservation interest in the Tanganyika-Nyasa Montane Forest Group.	Tanganyika-Nyasa Montane Forests														
	Eastern Arc Mountains								Other mountains						
	Taita	Pare S.	Usambaras (W&E)	Ngurus	Rubehos	Ukagurus	Ulugurus (N&S)	Udzungwas	Southern Highl.	N. Malawi	S. Malawi	Mt. Namuli	Mt. Chipe	Njesi Pl.	Elsewhere
Spotted Ground Thrush <i>Zoothera guttata</i>											Th				■ ¹
Namuli Apalis <i>Apalis lynesi</i> ⁸											Th				
No. of Th (Threatened) species	3	1	10	1	1	2	5	10	1	1	3	3	2	1	
No. of Nt (Near-threatened) species	0	0	4	3	2	1	3	3	1	0	0	0	0	0	
No. of xx (restr.-range other than Th and	0	4	5	5	5	4	6	6	6	4	0	0	0	1	
No. of Th, Nt and xx species	3	5	19	9	8	7	14	19	8	5	3	3	2	2	

Table 5.1. Forest bird species of special conservation interest in the *Tanganyika-Nyasa Montane Forest Group*. The table includes all Threatened, Near-threatened and other restricted-range¹ species occurring in this area. For each species a shortening of its global category of threat is used to "tick" the species in the table (see key below). Encircled squares: 11 species that are endemic to only a single mountain area.

Unpublished information from J. Fjeldså was used to compile the species list for the Rubeho Mountains and to a lesser extent the Pare Mountains. For other ranges we have used various publications.

Key, Tanganyika-Nyasa Montane Forests: Taita: Taita Hills and Mount Kasigau, Southern Kenya. Pares: Pare Mountains, Northern Tanzania. Usambaras: Usambara Mountains, Tanzania. Ngurus: Nguru Mountains, Tanzania. Ukagurus: Ukaguru Mountains, Tanzania. Ulugurus: Uluguru Mountains, Tanzania. Udzungwas: Udzungwa Mountains, Tanzania. S. Highl.: Southern Highlands of Tanzania. N. Malawi: Northern Malawi (includes mountain ranges north of 14°S, e.g. Misuku Hills, Nyika Plateau [a part of Nyika Plateau is in extreme NE Zambia], and Viphya Mountains). S. Malawi: Southern Malawi (includes mountain ranges south of 14°S, e.g. Shire Highlands, Mount Mulanje and Mount Thyolo). Mt. Namuli: Mount Namuli, Mozambique. Mt. Chiper.: Mount Chiperone, Mozambique. Njesi Pl.: Njesi Plateau, Mozambique. +: Forests outside the Tanganyika-Nyasa mountain range, these are explained under "Key, footnotes".

Certain areas, e.g. Northern Malawi, could be split into more biogeographical units, but the aim of Table 5.1 is only to give a rough overview. Especially the montane ranges in Mozambique are poorly known. See also (2) below.

Key, categories of threat: Threatened (Th): With category Threatened in Collar *et al.* (1994). (The category Threatened is further subdivided in Collar *et al.* (1994). For simplicity and because the book reached us a little late in the writing phase these subdivisions are not included here. Near-threatened (Nt): With category Near-threatened in Collar *et al.* (1994). Restricted-range but not Threatened or Near-threatened (xx): Not considered Threatened or Near-threatened in Collar *et al.* (1994) but with an estimated breeding range of less than 50,000 km². The estimations of breeding range are our own, see (1).

Key, footnotes given in Table 5.1: 1: Also in the Mahenge Highlands, isolated south of the Udzungwas and belonging to the Tanganyika-Nyasa Montane Forest Group, and in coastal Mozambique, near Beira. 2: Also in the Matengo Highlands, SW Tanzania, which are situated immediately south of the Southern Highlands. 3: Sokoke-Arabuko forest at the coast of Kenya (main population). 4: Three forests in eastern Zimbabwe (Chirinda Forest, Vumba Highlands, Stapleton) and Mount Gorongoza, Mozambique. 5: Coastal Sokoke-Arabuko Forest, Kenya (main

¹ A "restricted-range species" is defined as "a species with an estimated worldwide breeding range of less than 50,000 km²". The biodiversity mapping project described in ICBP (1992) was based on an assessment of the occurrence of restricted-range species, a coming BirdLife publication (The BirdLife Directory of Endemic Bird Areas, in prep.) will also be based on restricted-range species. Almost all Threatened and Near-threatened species are of restricted range but the following are probably not: *Circaetus fasciolatus* (Nt), *Zoothera guttata* (Th), *Sheppardia gunningi* (Th), *Anthreptes neglectus* (Nt) and *A. reichenowi* (Nt). The estimations of breeding ranges are our own. Certain marginal species (of the not Threatened or Near-threatened group) were considered for inclusion as restricted-range but were regarded just too widespread. Of these we would like to mention especially Olive-flanked Robin *Cossypha anomala*. Fülleborn's Black Boubou *Laniarius fuelleborni* (probably restricted-range if not conspecific with *L. poensis*) is not included as we follow Dowsett and Dowsett-Lemaire (1993) in regarding it conspecific with *L. poensis*. Malawi Batis *Batis dimorpha* (possibly restricted-range if given full species status as by a few authors) is not included since we e.g. Dowsett-Lemaire (1989) in not regarding it a full species (click on the footnote number to return to text).

population). 6: Certain montane forests in Kenya. 7: Several coastal forests of Tanzania, Mozambique and Kenya. 8: These are not given full species status in Dowsett and Dowsett-Lemaire (1993). 9: Earlier records exist from gallery forest around the lower Tana River, Kenya. It may still survive here in remaining forest patches though sometimes considered “possibly extinct”. 10: This remarkably elusive and little known migratory thrush also occurs (at least seasonally) in certain coastal forests of Kenya, Tanzania, northern Mozambique and South Africa. Two races are known from single specimens from Zaire and Sudan. 11: Discovered as recently as in 1991 (Dinesen *et al.* 1994). 12: Several coastal forests in Kenya, Tanzania (including Zanzibar) and Mozambique. 13: Coastal woodlands and forests from Southern Somalia south to Natal and Zululand in South Africa; inland in Voi, Kenya and Ruaha N.P., Tanzania. 14: Forests and well-wooded country in coastal lowlands from the lower Jubba Valley, Somalia, to Wami River, Tanzania (with records from Zanzibar in the 1930ies). Inland in Shimba Hills, Kenya, and on Mafi Mountain, Tanzania. 15: Also in the Uvidundas (south of the Rubehos). 16: Forests (locally moist bush land) in coastal Kenya and Tanzania (thinly distributed); also Shimba Hills, Kenya.

1. A “restricted-range species” is defined as “a species with an estimated worldwide breeding range of less than 50,000 km² “. The biodiversity mapping project described in ICBP (1992) was based on an assessment of the occurrence of restricted-range species, a coming BirdLife publication (*The BirdLife Directory of Endemic Bird Areas*, in prep.) will also be based on restricted-range species. Almost all Threatened and Near-threatened species are of restricted range but the following are probably not: *Circaetus fasciolatus* (Nt), *Zoothera guttata* (Th), *Sheppardia gunningi* (Th), *Anthreptes neglectus* (Nt), and *A. reichenowi* (Nt). The estimations of breeding ranges are our own. Certain marginal species (of the not Threatened or Near-threatened group) were considered for inclusion as restricted-range species but were regarded just too widespread. Of these we would like to mention especially Olive-flanked Robin *Cossypha anomala*. Fülleborn's Black Boubou *Laniarius fülleborni* (probably restricted-range if not conspecific with *L. poensis*) is not included as we follow Dowsett and Dowsett-Lemaire (1993) in regarding it conspecific with *L. poensis*. Malawi Batis *Batis dimorpha* (possibly restricted-range if given full species status as by a few authors) is not included since we follow e.g. Dowsett-Lemaire 1989) in not regarding it a full species.
2. Our list of forest bird species of special conservation importance in the Tanganyika-Nyasa Montane Forest Group may differ in certain respects from tables to be published for the Endemic Bird Area C24 in a coming BirdLife publication (*The BirdLife Directory of Endemic Bird Areas*, in prep.). The reasons are:
 - Though the name of C24 may be changed from “Eastern Arc Mountains” (as it was incorrectly called in ICBP [1992]) to “Tanganyika-Nyasa Mountains” in the directory, the editors may choose to regard e.g. the lowland avifauna of the Usambaras as part of the Kenya-Tanzanian coastal forest EBA C23 (we have included them in C24) - it is difficult to distinguish between these biogeographical zones due to problems with overlap (the occurrence in the Usambaras of e.g. *Tauraco fischeri*, *Otus irenae*, *Sheppardia gunningi*, and *Anthreptes reichenowi* is probably best explained by affinity to coastal forests). Some authors believe that the S. Malawian mountains belongs to another biogeographical unit (e.g. Stuart *et al.* 1993).
 - The coming directory from BirdLife may include only species of restricted range in their tables, using the text account for supplementary notes on Threatened and Near-threatened species not of restricted range, see (1). The editors of the directory may not follow the same taxonomy as we do (but may choose to follow e.g. Sibley and Monroe [1990] which will lead to the inclusion of some extra species).

Tabel 5.2. Montane forest bird subspecies endemic to a single Eastern Arc mountain range. Data from Stuart *et al.* 1993²

Mountain block	Endemic subspecies
Usambaras	<i>Arcanator orostruthus amani</i> <i>Orthotomus moreauioreai</i> <i>Ploceus nicolli nicolli</i> <i>Swynertonia swynnertoni</i> – unnamed subspecies ³
Ukagurus	<i>Sheppardia lowei</i> ⁴
Ulugurus	<i>Andropadus tephrolaemus neumanni</i> <i>Sheppardia sharpei bangsi</i> <i>Apalis thoracica uluguru</i> <i>Orthotomus metopias altus</i>
Udzungwas	<i>Swynertonia swynnertoni rogersi</i> <i>Arcanator orostruthus sanjei</i> <i>Apalis thoracica injectivora</i>

² Except for a new subspecies to be described by Anderson and Evans (in prep.)

³ Except for a new subspecies to be described by Anderson and Evans (in prep.)

⁴ Evan and Anderson (1992 and 1993a) who discovered the Ukaguru population did not mention that it might form its own subspecies

Table 5.3. Efforts of the ornithology team in the field.

Table 5.3. Efforts of the ornithology team in the field.	Standard mistnetting: two full days.	Other mistnetting.	One- hectare plots (10 minutes each).	Tape recordings at dawn.	General field observati ons.
Kimhandu-1 (1520 m).	80 m of nets. 2080 NMH.	None.	19	2	Yes.
Kimhandu-2 (1710 m).	109 m of nets. 2807 NMH.	109 m for 1.50 extra hours. 164 NMH.	25	2	Yes.
Kimhandu-3 (1940 m).	156 m of nets. 4056 NMH.	54 m of "new" nets to catch <i>B.w.</i> (c. 1 day). 56 m of "old" nets for c. 7.5 hours. Sum: 1022 NMH.	22	2	Yes.
Kimhandu-4 (2145 m).	109 m of nets. 2766 NMH.	None.	15	2	Yes.
Kimhandu-5 (2520 m).	116 m of nets. 2919 NMH.	None.	15	2	Yes.
Kimhandu-6 (1540 m).	None.	42 m for 13.5 hours. 567 NMH.	24	0	Yes.
Lanzi-1 (1710 m).	126 m of nets. 3213 NMH.	126 m of "old" nets for extra c. 6 hours. 12 m of "new" nets to catch <i>B.w.</i> (7.75 hours). Sum: 849 NMH.	16	2	Yes.
Lanzi-2 (1920 m).	110 m of nets. 2771 NMH.	89 m of "old" nets for extra c. 3.25 hours. Sum: 286 NMH.	17	2	Yes.
Lanzi-3 (2110 m).	148 m of nets. 3774 NMH.	40 m for 6.25 hours. Sum: 250 NMH.	15	2	Yes.
Tegetero-1 (1345 m).	134 m of nets. 3406 NMH.	None.	25	2	Yes.
Tegetero-2 (1535 m).	126 m of nets. 3245 NMH.	None.	20	1	Yes.
Tegetero-3 (1710 m).	146 m of nets. 3582 NMH.	None.	17	2	Yes.
Tchenezema (2150 m).	None.	None.	25	0	Yes.
Kimboza (c. 300 m).	None.	Little.	None.	0	Yes.
Bunduki (c. 1300-1500 m).	None.	None.	None.	0	Yes.
Morningside (c. 1500 m).	None.	None.	None.	0	Little.
Kiguruyembe (c. 700 m), Nov.-Dec. 1994.	None	60 m for 22 hours. 1320 NMH.	None.	0	Yes.

Table 5.3. Efforts of the ornithology team in the field. All localities visited during the survey are included. Their geographical position is described in the introductory section of this report. Concerning the intensity of general field observations: The amount of time and number of persons "available" varied quite much between the stations, we advise the reader to see Table 2.1 and Section 5.4. Abbreviation: *B.w.* = *Bathmocercus winifredae*.

Table 5.4. Altitudinal distributons A

Table 5.4. Altitudinal distributons A.	Main localities			Visits of c. 1.5 day			Few hours	Earlier Uluguru records
	Kimh.	Lanzi	Tegetero	Tchenz.	Kimb	Kigur.	Bunduki	
Altitudinal distribution of forest.	1450-2640	1560-2500	1050-2270	1950-2500	c. 300	≥650	1220-1540	
Altitudes visited during this survey (see also Section 5.4)	1450-2640 (little 2200- 2450 and ≤1520)	1560-2220 (little 2220- 2500 and ≤1710)	1100-1950 (little 1100- 1250 and ≥1710)	Mostly plots 2000-2050 (little ≤2000 and ≥2250)	c. 300	c. 650-850 + park at 600	Scattered observations	
ACCIPITRIDAE								
Southern Banded Snake Eagle <i>Circaetus fasciolatus</i>	---	---	---	---	300	---	---	300
Black Goshawk <i>Accipiter melanoleucus</i>	---	---	---	---	---	---	1300	1800
African Goshawk <i>A. tachiro</i>	1520-1940	1710-2110	1530-1710	---	---	650-850	---	1200, 1600
Forest Buzzard <i>Buteo oreophilus</i>	1430-2530	1680-2030	1270-1710	---	---	---	---	≥1500
Crowned Eagle <i>Stephanoaetus coronatus</i>	1520-2140	1900-2100	1300-1710	---	300	≥1000	---	300-2140
NUMIDIDAE, RALLIDAE								
Crested Guineafowl <i>Guttera pucherani</i>	---	---	---	---	300	---	---	"East. footh. forests"
Buff-spotted Flufftail <i>Sarothrura elegans</i>	---	---	---	---	---	---	---	900 + "Bagilo"
COLUMBIDAE								
Olive Pigeon <i>Columba arquatrix</i>	1520-2600	1690-2220	1200-1680	2100	---	---	---	1200-≥2300
Bronze-naped Pigeon <i>C. delegorguei</i>	1550-2145	1710-2000	1200-1635	2100	---	---	---	300-1800
Lemon Dove <i>Aplopelia larvata</i>	1550	1710-2220	1315-1710	---	---	---	---	300, ≥1500
Tambourine Dove <i>Turtur tympanistria</i>	1550-1600	1900-2000	1200-1345	---	---	650-850	---	300-≥2100
MUSOPHAGIDAE, CUCULIDAE								
Livingstone's Turaco <i>Tauraco livingstonii</i>	1430-2530	1570-2450	1130-1930	2000-2500	---	≥900	---	300-≥2600
Barred Long-tailed Cuckoo <i>Cercococcyx motanus</i>	1520-1870	1710-2030	1200-1740	---	300	---	---	300, -≥1500
GreenYellowbill <i>Ceuthmochares (aereus) australis</i>	---	---	---	---	---	---	---	400-1800
STRIGIDAE								
Barred Owllet <i>Glaucidium capense</i>	---	---	---	---	---	---	---	250
Wood Owl <i>Strix woodfordii</i>	1430-2145	1920-2100	1200-1720	---	300	650-850	---	300-≥2000
APODIDAE								
Scarce Swift <i>Schoutedenapus myoptilus</i>	2000-2520	1710-2570	1480-1890	2150	---	600-1000	---	---
TROGONIDAE								
Narina Trogon <i>Apaloderma narina</i>	---	---	---	---	300	---	---	300-1800
Bar-tailed Trogon <i>A. vittatum</i>	1520-2145	1670-2350	1130-1840	2000-2250	---	---	1550	300, 1200- 2000
BUCEROTIDAE								
Crowned Hornbill <i>Tockus alboterminatus</i>	---	---	---	---	300	---	---	300, 900
Trumpeter Hornbill <i>Ceratogymna bucinator</i>	---	---	---	---	300	---	---	300 + "Bagilo"

Table 5.4. Altitudinal distributons A.	Main localities			Visits of c. 1.5 day			Few hours	Earlier Uluguru records
	Kimh.	Lanzi	Tegetero	Tchenz.	Kimb	Kigur.	Bunduki	
Altitudinal distribution of forest.	1450-2640	1560-2500	1050-2270	1950-2500	c. 300	≥650	1220-1540	
Altitudes visited during this survey (see also Section 5.4)	1450-2640 (little 2200- 2450 and ≤1520)	1560-2220 (little 2220- 2500 and ≤1710)	1100-1950 (little 1100- 1250 and ≥1710)	Mostly plots 2000-2050 (little ≤2000 and ≥2250)	c. 300	c. 650-850 + park at 600	Scattered observations	
Silvery-cheeked Hornbill <i>C. brevis</i>	1430-2145	1690-2160	1130-1710	----	300	----	1500-1700	300-≥2000
LYBIIDAE								
White-eared Barbet <i>Stactolaema leucotis</i>	----	----	----	----	300	----	----	250 + "Mkaraji"
Green Barbet <i>S. olivacea</i>	1520-1960	1750-2060	1120-1710	----	----	650-850	1300	300, 900- 1800 ¹
Eastern Green Tinkerbird <i>Pogoniulus simplex</i>	----	----	----	----	----	----	----	300
Moustached Green Tinkerbird <i>P. leucomystax</i>	1500-2560	1710-2270	1200-1790	2000-2500	----	----	----	1300-≥2500
Yellow-rumped Tinkerbird <i>P. bilineatus</i>	1710-2145	----	1200-1500	----	300	650-850	----	300, 1100- 1500
INDICATORIDAE, PICIDAE								
Scaly-throated Honeyguide <i>Indicator variegatus</i>	----	----	1180	----	----	----	----	300, 1800*
Eastern Least Honeyguide <i>I. meliphilus</i>	----	----	----	----	----	----	----	900
Olive Woodpecker <i>Dendropicos griseocephalus</i>	1520-2520	1710-2110	1300-1530	2200-2500	----	----	----	1200-≥2300
EURYLAIMIDAE, CAMPEPHAGIDAE								
African Broadbill <i>Smithornis capensis</i>	1710	----	1200-1710	----	----	----	----	300-1800
Purple-throated Cuckoo-shrike <i>Campephaga quiscalina</i>	----	----	----	----	300	----	----	250-1700
Grey Cuckoo-shrike <i>Coracina caesia</i>	1940-1980	1690-2220	1120-1575	----	----	----	----	300-≥1900
PYCNONOTIDAE								
Shelley's Greenbul <i>Andropadus masukuensis</i>	1520-2145	1685-2120	1285-1710	2200	----	----	1300	900-≥2300
Uluguru Mountain Greenbul <i>A. (t.) neumanni</i>	1550-2640	1630-2220	1300-1910	2000-2500	----	----	----	1050, 1350- ≥2600
Stripe-cheeked Greenbul <i>A. olivaceiceps</i>	1520-2145	1710-1930	1300-1720	----	----	----	1300	250-1950
Little Greenbul <i>A. virens</i>	1430-1700	1680	1120-1200	----	300	650-850	1300	200-1800*
Yellow-bellied Greenbul <i>Chlorocichla flaviventris</i>	----	----	----	----	----	----	----	300
Grey-olive Greenbul <i>Phyllastrephus cerviniventris</i>	----	----	----	----	----	700	----	1500+"Ulu". "
Terrestrial Greenbul <i>P. terrestris</i>	----	----	----	----	300	----	----	Occuring. Altit.?
Fischer's Greenbul <i>P. fischeri</i>	----	----	----	----	----	650-850	----	300
Placidus Greenbul <i>P. placidus</i>	1520-2180	1630-2000	1200-1740	----	----	----	----	1200-≥2200
Yellow-streaked Greenbul <i>P. flavostriatus</i>	----	----	1200-1500	----	300	----	----	300-1500 (- 1800?*)
Tiny Greenbul <i>P. debilis</i>	----	----	----	----	300	----	----	≤400
TURDIDAE								
Red-tailed Ant Thrush <i>Neocossyphus rufus</i>	----	----	----	----	300	----	----	300-1500

Table 5.4. Altitudinal distributons A.	Main localities			Visits of c. 1.5 day			Few hours	Earlier Uluguru records
	Kimh.	Lanzi	Tegetero	Tchenz.	Kimb	Kigur.	Bunduki	
Altitudinal distribution of forest.	1450-2640	1560-2500	1050-2270	1950-2500	c. 300	≥650	1220-1540	
Altitudes visited during this survey (see also Section 5.4)	1450-2640 (little 2200- 2450 and ≤1520)	1560-2220 (little 2220- 2500 and ≤1710)	1100-1950 (little 1100- 1250 and ≥1710)	Mostly plots 2000-2050 (little ≤2000 and ≥2250)	c. 300	c. 650-850 + park at 600	Scattered observations	
Mountain (Olive Thrush) <i>Turdus (olivaceus) abyssinicus</i>	1520-2520	1630-2160	1200-1810	2000-2200	---	---	---	1100-≥2300
Orange Thrush <i>Zoothera gurneyi</i>	1520-2530	1690-2220	1290-1720	2000	---	700	---	1500-2000
White-chested Alethe <i>Alethe fuelleborni</i>	1520-2145	1700-2100	1180-1740	---	300	---	---	250-300, 1300-≥2000
Starred Robin <i>Pogonocichla stellata</i>	1500-2600	1630-2160	1270-1930	1700-2250	---	700	---	300-≥2300
Sharpe's Akalat <i>Sheppardia sharpei</i>	1520-2140	1670-1990	1200-1740	---	---	700	---	900-≥2000
Olive-flanked Robin <i>Cossypha anomala</i>	1520-2610	1630-2220	1430-1960	2000-2500	---	---	---	1500-≥2400
Red-capped Robin <i>C. natalensis</i>	---	---	---	---	300	650-850	---	300-1800*
SYLVIIDAE								
Evergreen Forest Warbler <i>Bradypterus mariae</i>	1430-2590	1630-2270	1120-1880	1600-2250	300	---	1300	250, 900- ≥2500
Mrs Moreau's Warbler <i>Bathmocercus winifredae</i>	1700-2020	1660-2160	1475-1740	2000-2430	---	---	---	1350-≥2350
Kretschmer' Longbill <i>Macrosphenus kretschmeri</i>	---	---	---	---	300	---	---	300- 400,1000- 1800*
Brown Woodland Warbler <i>Phylloscopus umbrovirens</i>	2370-2600	2220-2340	---	---	---	---	---	900?, 2100- 2650
Yellow-throated Warbler <i>P. ruficapillus</i>	1520-2150	1710-2160	1230-1745	---	---	---	---	900-≥2300
White-winged Apalis <i>Apalis chariessa</i>	---	---	1260-1300	---	---	---	---	1100-1500
Bar-throated Apalis <i>A. thoracica</i>	1520-2620	1630-2240	1270-1920	2100-2500	---	---	---	1200-≥2400
Chapin's Apalis <i>A. chapini</i>	1520-2200	1630-2270	1130-1745	---	---	---	---	1400-≥2350
Black-headed Apalis <i>A. melanocephala</i>	---	---	1290-1640	---	---	---	---	250-≥1500 (- 1800?)
Red-capped Forest Warbler <i>Orthotomus metopias</i>	1430-2570	1630-2310	1200-1930	1700-2150	---	---	---	(1000?-) 1200-≥2400
Green Camaroptera <i>Camaroptera brachyura</i>	1500-1540	---	1345	---	300	600-850	1300	300-1500
MUSCICAPIDAE, PLAYSTEIRIDAE, MONARCHIAE								
Dusky Flycatcher <i>Muscicapa adusta</i>	1430-1990	1570-2100	1290-1320	1700-2500	300	---	---	1100-≥1800
Ashy Flycatcher <i>M. caerulescens</i>	1430	---	---	---	---	---	---	250-1500
Forest Batis <i>Batis mixta</i>	1520-2170	1630-2230	1200-1710	2000-2100	300	---	---	300-≥2350
Black-throated Wattle-eye <i>Platysteira peltata</i>	---	---	---	---	---	650-850	---	1200+Ulug.+ Bagilo
Little Yellow Flycatcher <i>Erythrocerus holochlorus</i>	---	---	---	---	300	---	---	300
White-tailed Crested Flycatcher <i>Trochocercus albonotatus</i>	1520-2570	1690-2230	1200-1960	2000-2500	---	---	---	300, 1200- ≥2350

Table 5.4. Altitudinal distributons A.	Main localities			Visits of c. 1.5 day			Few hours	Earlier Uluguru records
	Kimh.	Lanzi	Tegetero	Tchenz.	Kimb	Kigur.	Bunduki	
Altitudinal distribution of forest.	1450-2640	1560-2500	1050-2270	1950-2500	c. 300	≥650	1220-1540	
Altitudes visited during this survey (see also Section 5.4)	1450-2640 (little 2200- 2450 and ≤1520)	1560-2220 (little 2220- 2500 and ≤1710)	1100-1950 (little 1100- 1250 and ≥1710)	Mostly plots 2000-2050 (little ≤2000 and ≥2250)	c. 300	c. 650-850 + park at 600	Scattered observations	
Blue-mantled Flycatcher <i>Trochocercus cyanomelas</i>	---	---	---	---	300	650-850	---	300-1700
Paradise Flycatcher <i>Terpsiphone viridis</i>	1500-2150	1690-2120	1130-1805	---	300	700	1500	1200-≥2200
TIMALIIDAE								
Spot-throat <i>Modulatrix stictigula</i>	1520-2590	1630-2350	1200-1940	2000-2250	---	---	---	600, 900- ≥2500
Pale-breasted Illadopsis <i>Illadopsis rufipennis</i>	---	---	---	---	300	---	---	300-900
African Hill Babbler <i>Alcippe abyssinica</i>	1520-1990	1710-2100	1430-1900	1700-2250	---	---	---	1200-≥2500
NECTARINIIDAE								
Uluguru Violet-backed Sunbird <i>Anthreptes neglectus</i>	---	---	---	---	300	---	---	300-1300 (- 1800?)
Banded Green Sunbird <i>A. rubritorques</i>	---	---	---	---	---	---	---	900-≥1600 (- 1800?)
Olive Sunbird <i>Nectarinia olivacea</i>	1530-1710	1710	1130-1675	2100	300	650-850	1300	300-≥1800
Loveridge's Sunbird <i>N. loveridgei</i>	1520-2580	1685-2475	1200-1960	2000-2500	---	---	---	1300-≥2350
ZOSTEROPIDAE, ORIOLIDAE								
Yellow White-eye <i>Zosterops senegalensis</i>	1520-2170	1700-2150	1270-1640	1700-2500	---	---	---	250-300, 1200-≥2500
Green-headed Oriole <i>Oriolus chlorocephalus</i>	---	---	1130-1740	2500	300	---	---	300-1600 (- 1800?)
MALACONOTIDAE, PRIONOPIDAE								
Fülleborn's Black Boubou <i>Laniarius fueleborni</i>	1550-2570	1630-2430	1130-1940	2000-2500	---	---	1300	900-≥2400
Blackfronted Bush Shrike <i>Telophorus nigrifrons</i>	1560-2000	1710-2110	1180-1740	---	---	---	---	300-400, 1200-≥2200
Four-coloured Bush Shrike <i>M. quadricolor</i>	---	---	---	---	---	---	---	Occuring. Altit.?
Uluguru Bush Shrike <i>M. alius</i>	---	---	1320-1710	---	---	---	---	1300-≥2100
Eastern Nicator <i>Nicator gularis</i>	---	---	---	---	300	650-850	1000	250-1000
DICRURIDAE, STURNIDAE								
Square-tailed Drongo <i>Dicrurus ludwigii</i>	1540	---	1200-1440	---	300	650-850	---	300-1400 (- 1800?)
Kenrick's Starling <i>Poeoptera kenricki</i>	1550-2500	1700-2500	1200-1550	---	---	---	---	300, 1300- 1800
Waller's Red-winged Starling <i>Onychognathus walleri</i>	1550-2220	1710-2220	1200-1740	2100	---	---	---	1100-≥2100
Black-bellied Glossy Starling <i>Lamprolornis corruscus</i>	---	---	---	---	---	---	---	300
PLOCEIDAE								

Table 5.4. Altitudinal distributons A.	Main localities			Visits of c. 1.5 day			Few hours	Earlier Uluguru records
	Kimh.	Lanzi	Tegetero	Tchenz.	Kimb	Kigur.	Bunduki	
Altitudinal distribution of forest.	1450-2640	1560-2500	1050-2270	1950-2500	c. 300	≥650	1220-1540	
Altitudes visited during this survey (see also Section 5.4)	1450-2640 (little 2200- 2450 and ≤1520)	1560-2220 (little 2220- 2500 and ≤1710)	1100-1950 (little 1100- 1250 and ≥1710)	Mostly plots 2000-2050 (little ≤2000 and ≥2250)	c. 300	c. 650-850 + park at 600	Scattered observations	
Dark-backed Weaver <i>Ploceus bicolor</i>	---	---	1130-1570	---	300	650-850	---	300-1400 (- 1800?)
Tanzanian Mountain Weaver <i>P. nicolli</i>	---	---	---	---	---	---	---	1400-1600 (- 1800?)
ESTRILDIDAE								
Red-faced Crimsonwing <i>Cryptospiza reichenovii</i>	1710-2520	1710-2110	1330-1820	2200	---	---	---	900-≥2200
Abyssinian Crimsonwing <i>C. salvadorii</i>	1430	---	---	1600	---	---	---	"Mbeta" + "Ulug."
Lesser Seed-cracker <i>Pyrenestes minor</i>	---	---	---	---	300	---	---	300-900
Red-throated Twinspot <i>Hypargos niveoguttatus</i>	---	---	---	---	---	650-850	---	3-400, 1200
Green Twinspot <i>Mandingoa nitidula</i>	---	---	---	---	300	---	---	1200-1500
FRINGILLIDAE								
Oriole Finch <i>Linurgus olivaceus</i>	1940-2530	1890-2100	---	2100	---	---	---	1100-≥1800

Table 5.4. Altitudinal distribution A. Complete distribution at the localities visited and literature records (previous pages)

- Altitudes are in meters above sea level.
 - Data from Kimhandu, Lanzi, Tegetero, Kimboza, Kigurunyemba and Bunduki are from this survey (see [A] below for Morningside).
 - Earlier/literature records: Information from Stuart and Jensen (1985) (see [B] and [C] below).
 - Records of non-forest species from this survey are listed in Appendix 5.6.
 - \geq : Up to at least...
 - \leq : Below...
 - *: For records marked with an asterisk (*) under “Earlier Uluguru records” the altitude 1800 is based on specimen labels from specimens collected at Bagilo by Andersen or his local collectors. Since all Andersen’s specimens from Bagilo were labelled 1800 m, the specimens may have been collected over a wide altitudinal range as discussed in Section 5.3. For species with an upper altitudinal limit given as 1800 m but without an asterisk: Stuart and Jensen (1985) did not mention whether this upper limit is based on Andersen specimens. We have made no attempt to check this further. For species with an upper altitudinal limit given as 1800 m and assigned with a (1), the upper limit is not based on Andersen’s specimens.
-
- A). Records from Morningside are not included, since observations were carried out only from outside forest (little time available). The forest species observed there (all at 1500 m) are: Crowned Eagle *Stephanoaetus coronatus*, Livingstone’s Turaco *Tauraco livingstonii*, Green Barbet *Stactolaema olivacea*, Little Greenbul *Andropadus virens* (outside border in small thicket) and Olive Sunbird *Nectarinia olivacea* (outside border near houses).
 - B). Stuart and Jensen (1985) reviewed all records of forest and non-forest bird species, published and unpublished, that they could find from the Ulugurus. Species not recorded by this survey but known from the Ulugurus elsewhere are included for completeness.
 - C). The following species were included in the list of forest species in Stuart and Jensen (1985) for reasons defined in their paper. We have however, chosen to regard them as non-forest species (although with much hesitation). Those of them which were recorded during this survey are marked with an asterisk and treated in our appendix of non-forest species: Little Sparrowhawk *Accipiter minullus* (*), Bat-like (Böhm’s) Spinetail *Neafrapus boehmi* (*), Mottled Spinetail *Telacanthura ussheri*, Golden-tailed Woodpecker *Campethera abingoni*, Little Spotted Woodpecker *C. cailliautii*, Cardinal Woodpecker *Dendropicos fuscescens*, Black Cuckoo-Shrike *Campephaga flava*, Lead-coloured Flycatcher *Myioparus plumbeus*, Black-and-White Flycatcher *Bias muscus* (*), Black-backed Puffback *Dryoscopus cubla* (*), Ret’s Red-billed Helmet Shrike *Prionops retzii* (*), Chestnut-fronted Helmet Shrike *P. scopifrons* and Collared Sunbird *Anthreptes collaris* (*). The following species were regarded as non-forest species by Stuart and Jensen (1985) but we treat them as forest species: Grey-olive Greenbul *Phyllastrephus cerviniventris* and Black-throated Wattle-eye *Platysteira peltata*.

Table 5.5. Altitudinal distributions B

Table 5.5. Altitudinal distributions B.	Kim-11520 m	Kim-61540 m	Kim-21710 m	Kim-3 1940 m	Kim-42145 m	Kim-52520 m	Lan-11710 m	Lan-21920 m	Lan-32110 m	Teg-11345 m	Teg-21535m	Teg-3 1710 m
<i>Accipiter tachiro</i>	■	■	■	■			■	■	■		■	■
<i>Buteo oreophilus</i>	■	■	■	■	■	■	■	■		■	■	■
<i>Stephanoaetus coronatus</i>	■		■	■	■			■	■	■	■	■
<i>Columba arquatrix</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>C. delegorguei</i>		■	■	■	■		■			■	■	
<i>Aplopelia larvata</i>		■	■				■	■	■	■	■	■
<i>Turtur tympanistria</i>		■						■		■		
<i>Tauraco persa</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Cercococcyx montanus</i>	■		■				■			■	■	■
<i>Chrysococcyx klaas NF</i>		■		■						■	■	
<i>Strix woodfordii</i>		■	■	■	■			■	■	■	■	■
<i>Schouted. myioptilus AF</i>						■	■				■	
<i>Apaloderma vittatum</i>	■	■	■	■	■		■	■	■	■	■	■
<i>Ceratogymna brevis</i>	■	■	■	■	■		■	■	■	■	■	■
<i>Stactolaema olivacea</i>	■	■	■	■			■		■	■	■	■
<i>Pogoniulus leucomystax</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>P. bilineatus</i>	■	■	■	■	■						■	
<i>Dendropicus griseocephalus</i>	■	■	■	■	■	■	■		■	■	■	
<i>Smithornis capensis</i>			■							■	■	■
<i>Coracina caesia</i>				■			■	■	■	■	■	
<i>Andropadus masukuensis</i>	■	■	■	■	■		■	■	■	■	■	■
<i>A. (t) neumanni</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>A. olivaceiceps</i>	■	■	■	■	■		■	■		■	■	■
<i>A. virens</i>	■	■					■					
<i>Phyllastrephus placidus</i>	■	■	■	■	■		■	■	■	■	■	■
<i>P. flavostriatus</i>										■	■	
<i>Turdus (olivaceus) abyssinicus</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Zoothera gurneyi</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Alethe fuelleborni</i>	■	■	■	■	■		■	■	■	■	■	■

Table 5.5. Altitudinal distributions B.	Kim-11520 m	Kim-61540 m	Kim-21710 m	Kim-3 1940 m	Kim-42145 m	Kim-52520 m	Lan-11710 m	Lan-21920 m	Lan-32110 m	Teg-11345 m	Teg-21535m	Teg-3 1710 m
<i>Pogonocichla stellata</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Sheppardia sharpei</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Cossypha anomala</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Bradypterus mariae</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>B. cinnamomeus NF</i>					■	■	■		■			
<i>Bathmocercus winifredae</i>				■			■	■	■		■	■
<i>Phylloscopus umbrovirens</i>						■			■			
<i>P. ruficapillus</i>	■		■	■	■		■	■	■	■	■	■
<i>Apalis chariessa</i>										■		
<i>A. thoracica</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>A. chapini</i>	■	■	■	■	■		■	■	■	■	■	■
<i>A. melanocephala</i>										■		
<i>Orthotomus metopias</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Camaroptera brachyura</i>	■	■								■		
<i>Muscicapa adusta</i>	■			■			■	■	■	■		
<i>Batis mixta</i>	■	■	■	■	■		■	■	■	■	■	■
<i>Trochocercus albonotatus</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Terpsiphone viridis</i>	■	■	■	■	■		■	■	■	■	■	■
<i>Modulatrix stictigula</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Alcippe abyssinica</i>	■	■	■	■			■	■	■		■	
<i>Nectarinia olivacea</i>	■						■			■	■	■
<i>N. loveridgei</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Zosterops senegalensis</i>	■	■	■	■	■		■	■	■	■	■	■
<i>Oriolus chlorocephalus</i>											■	■
<i>Laniarius fuelleborni</i>	■	■	■	■	■	■	■	■	■	■	■	■
<i>Telophorus nigrifrons</i>		■	■				■		■	■	■	■
<i>Malaconotus alius</i>										■	■	■
<i>Dicrurus ludwigii</i>		■								■		
<i>Poeoptera kenricki</i>		■				■		■	■		■	
<i>Onychognathus walleri</i>	■	■	■	■	■		■	■	■	■	■	■

Table 5.5. Altitudinal distributions B.	Kim-11520 m	Kim-61540 m	Kim-21710 m	Kim-3 1940 m	Kim-42145 m	Kim-52520 m	Lan-11710 m	Lan-21920 m	Lan-32110 m	Teg-11345 m	Teg-21535m	Teg-3 1710 m
<i>Ploceus bicolor</i>										■	■	
<i>Cryptospiza reichenovii</i>	■	■	■	■		■	■	■	■	■	■	■
<i>C. salvadorii</i>		■										
<i>Linurgus olivaceus</i>				■	■	■		■	■			
Forest species (AF)	41	44(43)	42	42	35	21	43	41	41	49	50	42
AF forest species	0	0	0	0	0	1	1	0	0	0	1	0
Non-forest species	0	1(2)	0	1	1	1	1	0	1	1	1	0

Table 5.5. Altitudinal distributions B. Records from within +/- 50 m elevational range of 12 stations. Data obtained by all methods used in the field are combined. Non-forest species are included only if they were scored during mistnetting or on plots. Tchenzema is not included since we consider the efforts there too different from efforts at the other stations (data collected over a wide altitudinal range and no mistnetting/tape recording). *NF*: Non-forest species. *AF*: Aerial feeding forest species

Table 5.6. Mistnetting A.

Table 5.6. Mistnetting A.	Number of individuals ringed.												Sum
	Kim-1 1520m	Kim-6 1540m	Kim-2 1710m	Kim-3 1940m	Kim-4 2145m	Kim-5 2520m	Lan-1 1710m	Lan-2 1920m	Lan-3 2110m	Teg-1 1345m	Teg-2 1535m	Teg-3 1710m	
<i>Aplopelia larvata</i>	-	-	-	-	-	-	1	-	4	-	-	-	5
<i>Apaloderma vittatum</i>	-	-	1	-	-	-	-	-	-	-	1	-	2
<i>Pogoniolus leucomystax</i>	-	1	-	-	-	1	-	-	-	-	-	-	2
<i>Smithornis capensis</i>	-	-	-	-	-	-	-	-	-	-	1	-	1
<i>Andropadus masukuensis</i>	4	6 [1]	9	13	3	-	7 {1}	5	6	6	7	8	74
<i>A. (t) neumanni</i>	-	-	-	8	1	5	3	7	5	-	-	3	32
<i>A. olivaceiceps</i>	3	2	3	2	-	-	-	-	-	3	-	1	14
<i>A. virens</i>	5	4	-	-	-	-	-	-	-	-	-	-	9
<i>Phyllastrephus placidus</i>	4	2	1	12	4	-	3	2	-	6	2	3	39
<i>Turdus (olivaceus)abyssinicus</i>	-	-	3	3	-	1	2 [1]	-	-	-	1	3	13
<i>Zoothera gurneyi</i>	1	-	2	1	-	4	-	-	-	-	2	-	10
<i>Alethe fuelleborni</i>	7	-	5	4	2	-	3	-	-	6	5	1	33
<i>Pogonocichla stellata</i>	4 [2]	7	10 [1]	8 [1]	4	5	6 [4]	8 [2]	9 [3]	5 [1]	2 [1]	1 [1]	69
<i>Sheppardia sharpei</i>	-	-	5 [1]	2	-	-	-	-	-	9 [2]	6 [1]	3	25
<i>Cossypha anomala</i>	-	-	-	5 [2]	4	5	3	1	2 [1]	-	-	-	20
<i>Bradypterus mariae</i>	-	-	1	4	1	1	2	3	6	5	-	2	25
<i>B. cinnamomeus NF</i>	-	-	-	-	-	1	-	-	-	-	-	-	1
<i>B. mariae/cinnamomeus</i>	-	-	-	-	-	3	-	-	-	-	-	-	3
<i>Bathmocercus winifredae</i>	-	-	-	2	-	-	4	-	-	-	-	-	6
<i>Phylloscopus umbrovirens</i>	-	-	-	-	-	4	-	-	-	-	-	-	4
<i>P. ruficapillus</i>	4	-	1	5	-	-	3	1	2	-	1	-	17
<i>Apalis thoracica</i>	1	-	1	13	2	10	7	7	9	-	1	1	52
<i>Orthotomus metopias</i>	1	3	1	4	2	4	4	1	3	2	2	3	30
<i>Muscicapa adusta</i>	-	-	-	-	-	-	1	-	-	-	-	-	1
<i>Batis mixta</i>	3	1	1	6	4	-	3	3	-	1	3	-	25
<i>Trochocercus albonotatus</i>	3	4	3	6	1	1	6	5	2	3	1	1	36
<i>Modulatrix stictigula</i>	-	1	-	13	2	3	2	10	-	3	6	8	48
<i>Alcippe abyssinica</i>	-	1	-	4	-	-	2	-	2	-	-	-	9
<i>Nectarinia olivacea</i>	3	-	-	-	-	-	-	-	-	18	3	-	24
<i>N. loveridgei</i>	28	12	24	37	27	13	21	43 {3} [1]	8	7	32 {2} [3]	19 [2]	271
<i>Zosterops senegalensis</i>	-	2	-	2	-	-	3	-	-	-	-	-	7
<i>Laniarius fuelleborni</i>	-	-	-	-	-	1	2	-	-	1	-	-	4
<i>Cryptospiza reichenovii</i>	6	1	7	4	-	2	4	1	7	8	3	2	45

Table 5.6. Mistnetting A.	Number of individuals ringed.												Sum
	Kim-1 1520m	Kim-6 1540m	Kim-2 1710m	Kim-3 1940m	Kim-4 2145m	Kim-5 2520m	Lan-1 1710m	Lan-2 1920m	Lan-3 2110m	Teg-1 1345m	Teg-2 1535m	Teg-3 1710m	
<i>Linurgus olivaceus</i>	-	-	-	1	-	-	-	-	2	-	-	-	3
No. of individuals ringed	77	47	78	159	57	64	92	97	67	83	79	59	959
No. of species ringed	15	14	17	23	13	16	22	14	14	15	18	15	33

Table 5.6. Total number of birds mistnetted in the Uluguru North and South F.R.s. All individuals mistnetted in the northern and southern section (standardised and other mistnetting, see Table 5.3) during our survey are included. Kimboza data: see Table 5.11.

NF: Non-forest species.

{}: Number of juvenile birds mistnetted.

[: Number of immature birds mistnetted.

Age was determined for almost all individuals (maximum of undetermined for any species: 11.5 %).

Table 5.7. Mistnetting B, Number of individuals ringed.

Table 5.7. Mistnetting B.	Number of individuals ringed.											
	Kim-1 1520 m	Kim-2 1710 m	Kim-3 1940 m	Kim-4 2145 m	Kim-5 2520 m	Lan-1 1710 m	Lan-2 1920 m	Lan-3 2110 m	Teg-1 1345 m	Teg-2 1535 m	Teg-3 1710 m	Sum
<i>Aplopelia larvata</i>	-	-	-	-	-	1	-	4	-	-	-	5
<i>Apaloderma vittatum</i>	-	1	-	-	-	-	-	-	-	1	-	2
<i>Pogoniolus leucomystax</i>	-	-	-	-	1	-	-	-	-	-	-	1
<i>Smithornis capensis</i>	-	-	-	-	-	-	-	-	-	1	-	1
<i>Andropadus masukuensis</i>	4	9	10	3	-	7 {1}	5	6	6	7	8	65
<i>A. (t.) neumanni</i>	-	-	8	1	5	2	6	4	-	-	3	29
<i>A. olivaceiceps</i>	3	3	2	-	-	-	-	-	3	-	1	12
<i>A. virens</i>	5	-	-	-	-	-	-	-	-	-	-	5
<i>Phyllastrephus placidus</i>	4	1	11	4	-	3	-	-	6	2	3	34
<i>Turdus (olivaceus) abyssinicus</i>	-	3	3	-	1	2 [1]	-	-	-	1	3	13
<i>Zoothera gurneyi</i>	1	2	1	-	4	-	-	-	-	2	-	10
<i>Alethe fuelleborni</i>	7	5	4	2	-	2	-	-	6	5	1	32
<i>Pogonocichla stellata</i>	4 [2]	10 [1]	7	4	5	5 [3]	6 [2]	8 [2]	5 [1]	2 [1]	1 [1]	57
<i>Sheppardia sharpei</i>	-	4 [1]	2	-	-	-	-	-	9 [2]	6 [1]	3	24
<i>Cossypha anomala</i>	-	-	4 [1]	4	5	2	1	2 [1]	-	-	-	18
<i>Bradypterus mariae</i>	-	-	3	1	1	2	3	6	5	-	2	23
<i>B. cinnamomeus NF</i>	-	-	-	-	1	-	-	-	-	-	-	1
<i>B. mariae/cinnamomeus</i>	-	-	-	-	3	-	-	-	-	-	-	3
<i>Bathmocercus winifredae</i>	-	-	-	-	-	2	-	-	-	-	-	2
<i>Phylloscopus umbrovirens</i>	-	-	-	-	4	-	-	-	-	-	-	4
<i>P. ruficapillus</i>	4	1	5	-	-	3	1	2	-	1	-	17
<i>Apalis thoracica</i>	1	1	8	2	10	6	6	9	-	1	1	45
<i>Orthotomus metopias</i>	1	1	3	2	4	4	1	3	2	2	3	26
<i>Muscicapa adusta</i>	-	-	-	-	-	-	-	-	-	-	-	0
<i>Batis mixta</i>	3	1	4	4	-	3	3	-	1	3	-	22
<i>Trochocercus albonotatus</i>	3	3	5	1	1	4	4	2	3	1	1	28
<i>Modulatrix stictigula</i>	-	-	10	2	3	2	5	-	3	6	8	39
<i>Alcippe abyssinica</i>	-	-	4	-	-	2	-	2	-	-	-	8
<i>Nectarinia olivacea</i>	3	-	-	-	-	-	-	-	18	3	-	24
<i>N. loveridgei</i>	28	24	27	27	13	16	42{1}[3]	8	7	32{2}[3]	19 [2]	243
<i>Zosterops senegalensis</i>	-	-	2	-	-	3	-	-	-	-	-	5
<i>Laniarius fuelleborni</i>	-	-	-	-	1	2	-	-	1	-	-	4
<i>Cryptospiza reichenovii</i>	6	7	4	-	2	3	1	6	8	3	2	42
<i>Linurgus olivaceus</i>	-	-	1	-	-	-	-	2	-	-	-	3
Individuals ringed	77	76	128	57	64	76	84	64	83	79	59	847

Table 5.7. Mistnetting B.	Number of individuals ringed.											
	Kim-1 1520 m	Kim-2 1710 m	Kim-3 1940 m	Kim-4 2145 m	Kim-5 2520 m	Lan-1 1710 m	Lan-2 1920 m	Lan-3 2110 m	Teg-1 1345 m	Teg-2 1535 m	Teg-3 1710 m	Sum
Forest species ringed	15	16	22	13	15	21	13	14	15	18	15	31
Non-forest spp. ringed	0	0	0	0	1	0	0	0	0	0	0	1
Length of nets (m)	80	109	156	109	116	126	110	148	134	126	146	1,360
Effort in NMH	2,080	2,807	4,056	2,766	2,919	3,213	2,771	3,774	3,406	3,245	3,582	34,619

Table 5.7. Mistnetting B. Number of birds ringed during standardised mistnetting in the Uluguru North and South F.R.s. Essentially the same data as in Table 5.6 but standardised to two full days of mistnetting by:

A: We have excluded individuals mistnetted in nets put up specifically to catch *Bathmocercus winifredae* or in nets that had been run for more than two days (relevant for the stations Kimhandu-2 and -3 and for Lanzi-1, -2 and -3, see Table 5.3).

B: We have excluded data from Kimhandu-6 (1540 m) where we mistnetted for only 13.5 hours.

Table 5.8. Mistnetting C, Number of individuals ringed pr. 2500 NMH.

Table 5.8. Mistnetting C.	Number of individuals ringed pr. 2500 NMH (by mistnetting for two full days).										
	Kim-1 1520 m	Kim-2 1710 m	Kim-3 1940 m	Kim-4 2145 m	Kim-5 2520 m	Lan-1 1710 m	Lan-2 1920 m	Lan-3 2110 m	Teg-1 1345 m	Teg-2 1535 m	Teg-3 1710 m
<i>Aplopelia larvata</i>	-	-	-	-	-	0.8	-	2.7	-	-	-
<i>Apaloderma vittatum</i>	-	0.9	-	-	-	-	-	-	-	0.8	-
<i>Pogoniolus leucomystax</i>	-	-	-	-	0.9	-	-	-	-	-	-
<i>Smithornis capensis</i>	-	-	-	-	-	-	-	-	-	0.8	-
<i>Andropadus masukuensis</i>	4.8	8.0	6.2	2.7	-	5.4	4.5	4.0	4.4	5.4	5.6
<i>A. (t.) neumanni</i>	-	-	4.9	0.9	4.3	1.6	5.4	2.7	-	-	2.1
<i>A. olivaceiceps</i>	3.6	2.7	1.2	-	-	-	-	-	2.2	-	0.7
<i>A. virens</i>	6.0	-	-	-	-	-	-	-	-	-	-
<i>Phyllastrephus placidus</i>	4.8	0.9	6.2	3.6	-	2.3	-	-	4.4	1.5	2.1
<i>Turdus (olivaceus) abyssinicus</i>	-	2.7	1.8	-	0.9	1.6	-	-	-	0.8	2.1
<i>Zoothera gurneyi</i>	1.2	1.8	0.6	-	3.4	-	-	-	-	1.5	-
<i>Alethe fuelleborni</i>	8.4	4.5	2.5	1.8	-	1.6	-	-	4.4	3.9	0.7
<i>Pogonocichla stellata</i>	4.8	8.9	4.3	3.6	4.3	3.9	5.4	5.3	3.7	1.5	0.7
<i>Sheppardia sharpei</i>	-	3.6	1.2	-	-	-	-	-	6.6	4.6	2.1
<i>Cossypha anomala</i>	-	-	2.5	3.6	4.3	1.6	0.9	1.3	-	-	-
<i>Bradypterus mariae</i>	-	-	1.8	0.9	0.9	1.6	2.7	4.0	3.7	-	1.4
<i>B. cinnamomeus NF</i>	-	-	-	-	0.9	-	-	-	-	-	-
<i>B. mariae/cinnamomeus</i>	-	-	-	-	2.6	-	-	-	-	-	-
<i>Bathmocercus winifredae</i>	-	-	-	-	-	1.6	-	-	-	-	-
<i>Phylloscopus umbrovirens</i>	-	-	-	-	3.4	-	-	-	-	-	-
<i>P. ruficapillus</i>	4.8	0.9	3.1	-	-	2.3	0.9	1.3	-	0.8	-
<i>Apalis thoracica</i>	1.2	0.9	4.9	1.8	8.6	4.7	5.4	6.0	-	0.8	0.7
<i>Orthotomus metopias</i>	1.2	0.9	1.8	1.8	3.4	3.1	0.9	2.0	1.5	1.5	2.1
<i>Muscicapa adusta</i>	-	-	-	-	-	-	-	-	-	-	-
<i>Batis mixta</i>	3.6	0.9	2.5	3.6	-	2.3	2.7	-	0.7	2.3	-
<i>Trochocercus albonotatus</i>	3.6	2.7	3.1	0.9	0.9	3.1	3.6	1.3	2.2	0.8	0.7
<i>Modulatrix stictigula</i>	-	-	6.2	1.8	2.6	1.6	4.5	-	2.2	4.6	5.6
<i>Alcippe abyssinica</i>	-	-	2.5	-	-	1.6	-	1.3	-	-	-
<i>Nectarinia olivacea</i>	3.6	-	-	-	-	-	-	-	13.2	2.3	-
<i>N. loveridgei</i>	33.7	21.4	16.0	24.4	11.1	12.4	37.9	5.3	5.1	24.7	13.3
<i>Zosterops senegalensis</i>	-	-	1.2	-	-	2.3	-	-	-	-	-
<i>Laniarius fuelleborni</i>	-	-	-	-	0.9	1.6	-	-	0.7	-	-
<i>Cryptospiza reichenovii</i>	7.2	6.2	2.5	-	1.7	2.3	0.9	4.0	5.9	2.3	1.4
<i>Linurgus olivaceus</i>	-	-	0.6	-	-	-	-	1.3	-	-	-

Table 5.8. Mistnetting C.	Number of individuals ringed pr. 2500 NMH (by mistnetting for two full days).										
	Kim-1 1520 m	Kim-2 1710 m	Kim-3 1940 m	Kim-4 2145 m	Kim-5 2520 m	Lan-1 1710 m	Lan-2 1920 m	Lan-3 2110 m	Teg-1 1345 m	Teg-2 1535 m	Teg-3 1710 m
Catch rate (ind./2500 NMH)	92.5	67.7	77.7	51.5	54.8	59.1	75.8	42.4	60.9	60.9	41.2

Table 5.8. Mistnetting C. Number of birds ringed per 2500 NMH of standardised mistnetting in the Uluguru North and South F.R.s. Calculated from data in Table 5.7. The effort 2500 NMH was chosen as "index" because it equals 100 m of nets opened for two days of 12.5 hours each (roughly the day-length in the Eastern Arc).

Table 5.9. One-hectare plots.

Table 5.9. One-hectare plots.	Percentage of plots with species recorded (% of total number [N] of plots made at the station).												
	Kim-1 1520 m N=19	Kim-6 1540 m N=24	Kim-2 1710 m N=25	Kim-3 1940 m N=22	Kim-4 2145 m N=15	Kim-5 2520 m N=15	Lan-1 1710 m N=16	Lan-2 1920 m N=17	Lan-3 2110 m N=15	Teg-1 1345 m N=25	Teg-2 1535 m N=20	Teg-3 1710 m N=17	Tchen 2150 m N=25
	<i>Accipiter tachiro</i>								5.9				5.9
<i>Buteo oreophilus</i>											5.0		
<i>Columba arquatrix</i>	21.1		28.0	13.6	40.0*	13.3	25.0	41.2	26.7	8.0	10.0		4.0
<i>C. delegorguei</i>		16.7		13.6						8.0	5.0		4.0
<i>Aplopelia larvata</i>		4.2							6.7				
<i>Turtur tympanistria</i>										12.0			
<i>Tauraco livingstonii</i>	15.8	16.7	32.0	18.2	6.7	6.7	25.0	23.5	13.3	4.0	35.0*	41.2*	60.0*
<i>Cercococcyx montanus</i>	5.3									4.0	5.0		
<i>Chrysococcyx klaas NF</i>		4.2											
<i>Schout. myoptilus AF</i>											20.0		4.0
<i>Apaloderma vittatum</i>	10.5	16.7	12.0		6.7		25.0	29.4	13.3	12.0	15.0	5.9	8.0
<i>Ceratogymna brevis</i>	5.3		24.0	9.1	13.3		18.8	23.5	13.3	36.0	5.0		20.0
<i>Stactolaema olivacea</i>	10.5	12.5	8.0	9.1			6.3			12.0			
<i>Pogoniolus leucomystax</i>	26.3	29.2	76.0	63.6*	13.3		12.5	23.3	6.7	20.0	15.0	11.8	92.0*
<i>P. bilineatus</i>	10.5	8.3	12.0	18.2									
<i>Dendropicos griseocephalus</i>				4.5	6.7		12.5						
<i>Smithornis capensis</i>										8.0	5.0		
<i>Coracina caesia</i>									6.7	8.0	15.0		
<i>Andropadus masukuensis</i>	52.6	87.5	36.0	9.1	13.3		18.8	29.4	26.7	8.0	30.0*	5.9	4.0
<i>A. (t.) neumanni</i>	5.3	12.5	32.0	77.3*	80.0*	53.3*	81.3*	82.4*	93.3*		5.0	47.1*	92.0*
<i>A. olivaceiceps</i>	26.3	16.7	20.0	13.6			6.3	5.9		28.0	20.0		
<i>A. virens</i>	36.8*	45.8											
<i>Phyllastrephus placidus</i>	26.3	4.2	8.0	22.7	20.0		6.3	5.9	13.3	40.0*	20.0	5.9	
<i>P. flavostriatus</i>										12.0			
<i>Turdus (olivaceus) abyssinicus</i>	31.6	37.5	28.0	31.8	20.0		43.8	29.4	40.0*		20.0	17.6	
<i>Zoothera gurneyi</i>		16.7	8.0	13.6			12.5	5.9			5.0		4.0
<i>Alethe fuelleborni</i>	5.3	4.2		9.1	6.7		6.3	5.9		8.0	20.0	17.6	
<i>Pogonocichla stellata</i>	42.1*	70.8	52.0	50.0*	6.7	6.7	18.8	17.6	40.0*	4.0	25.0	17.6	48.0*
<i>Sheppardia sharpei</i>		16.7		9.1			6.3			44.0*	25.0	11.8	
<i>Cossypha anomala</i>	15.8	12.5	4.0	22.7	6.7	20.0	31.3	23.5	33.3		10.0	17.6	40.0
<i>Bradypterus mariae</i>	47.4*	45.8	52.0	45.5	20.0	46.7*	56.3*	70.6*	60.0*	44.0*	55.0*	47.1*	72.0*
<i>B. cinnamomeus NF</i>						66.7*			13.3				
<i>Bathmocercus winifredae</i>				13.6			6.3		6.7				16.0
<i>Phylloscopus umbrovirens</i>						26.7							4.0
<i>P. ruficapillus</i>			20.0	18.2	13.3		18.8	17.6	26.7	8.0	25.0	23.5	

One-hectare plots.	Percentage of plots with species recorded (% of total number [N] of plots made at the station).												
	Kim-1 1520 m N=19	Kim-6 1540 m N=24	Kim-2 1710 m N=25	Kim-3 1940 m N=22	Kim-4 2145 m N=15	Kim-5 2520 m N=15	Lan-1 1710 m N=16	Lan-2 1920 m N=17	Lan-3 2110 m N=15	Teg-1 1345 m N=25	Teg-2 1535 m N=20	Teg-3 1710 m N=17	Tchen 2150 m N=25
<i>Apalis thoracica</i>	15.8	20.8	12.0	27.3	46.7*	53.3*	68.8*	70.6*	66.7*	12.0	30.0*	23.5	36.0
<i>A. chapini</i>	5.3	16.7	16.0	13.6	33.3*		6.3	17.6	33.3	24.0	5.0	23.5	
<i>A. melanocephala</i>										16.0			
<i>Orthotomus metopias</i>	5.3	16.7	12.0	9.1	13.3	13.3	43.8	29.4	66.7*	20.0	35.0*	47.1*	4.0
<i>Camaroptera brachyura</i>	21.1	12.5											
<i>Muscicapa adusta</i>	10.5						6.3						
<i>Batis mixta</i>		25.0	12.0	18.2	26.7		18.8	11.8	13.3	12.0	25.0	11.8	8.0
<i>Trochocercus albonotatus</i>	36.8	62.5	32.0	22.7	13.3	20.0	43.8	41.2*	40.0*	68.0*	60.0*	52.9*	44.0*
<i>Terpsiphone viridis</i>		12.5	4.0	9.1	6.7		31.3		13.3	36.0	30.0*	11.8	
<i>Modulatrix stictigula</i>	10.5	29.2	28.0	59.1*	6.7	40.0*	50.0*	35.3	33.3	52.0*	55.0*	76.5*	20.0
<i>Alcippe abyssinica</i>		12.5		13.6			6.3	5.9	26.7		5.0		24.0
<i>Nectarinia olivacea</i>										88.0*	15.0		4.0
<i>N. loveridgei</i>	73.7	62.5	68.0	81.8*	93.3*	53.3*	75.0*	94.1*	53.3*	52.0*	70.0*	94.1*	60.0*
<i>Zosterops senegalensis</i>	21.1	33.3	44.0	4.5	6.7		18.8	5.9	13.3	20.0	25.0	11.8	8.0
<i>Oriolus chlorocephalus</i>											5.0		
<i>Dryoscopus cubla NF</i>													8.0
<i>Laniarius aethiopicus NF</i>													16.0
<i>L. fuelleborni</i>	10.5	33.3	20.0	36.4	13.3	33.3*	6.3	17.6	13.3	28.0	15.0	5.9	48.0*
<i>Telophorus nigrifrons</i>		8.3					6.3		6.7	28.0	15.0	23.5	
<i>Malaconotus alius</i>										4.0	5.0	5.9	
<i>Dicrurus ludwigii</i>										20.0			
<i>Poeptera kenricki</i>		4.2											
<i>Onychognathus walleri</i>	10.5	25.0	8.0		13.3		18.8	35.3*	66.7*	20.0	5.0	23.5	16.0
<i>Ploceus bicolor</i>										20.0	5.0		
<i>Cryptospiza reichenovii</i>	10.5	8.3	4.0	9.1						32.0	10.0	5.9	4.0
<i>Linurgus olivaceus</i>						6.7		5.9					4.0
Unidentified bird(s)	15.8	37.5	36.0	54.5	33.3	6.7	31.3	52.9	13.3	28.0	30.0	23.5	20.0
Forest species (-AF)	30	35	29	33	26	14	34	29	29	38	40	28	27
AF forest species	0	0	0	0	0	0	0	0	0	0	1	0	1
Non-forest species	0	1	0	0	0	1	0	0	1	0	0	0	2
"Step size" (%)	5.3	4.2	4.0	4.5	6.7	6.7	6.3	5.9	6.7	4.0	5.0	5.9	4.0
μ and s, forest species only	$\mu=6.3$ s=2.0	$\mu=8.6$ s=2.4	$\mu=7.1$ s=1.8	$\mu=8.3$ s=2.8	$\mu=5.5$ s=2.6	$\mu=4.0$ s=2.0	$\mu=8.4$ s=2.6	$\mu=8.1$ s=2.8	$\mu=8.5$ s=2.3	$\mu=8.8$ s=2.8	$\mu=7.9$ s=1.9	$\mu=7.0$ s=1.5	$\mu=7.5$ s=2.4
μ and s, AF and NF species included	-"	$\mu=8.6$ s=2.4	-"	-"	-"	$\mu=4.6$ s=2.0	-"	-"	$\mu=8.7$ s=2.3	-"	$\mu=8.1$ s=2.0	-"	$\mu=7.8$ s=2.5

Table 5.9. One-hectare plots. Percentage of plots with species recorded. Each plot was assessed for 10 minutes. Aerial feeding non-forest species are not included. *: The score of the species (measured in %) is among the 5 highest for the station (note: more than five species can receive an asterisk if some species have an equal score). *NF*: Non-forest species. *AF*: Aerial feeding forest species. μ : Mean number of species per plot (s: standard deviation). "Step size": Reciprocal value of the number of plots (example: s.s. = 5.0 % for 20 plots).

Table 5.10. Tape recordings at dawn.

Table 5.10. Tape recordings at dawn.	Number of birds audible (morning 1/morning 2)										
	Kim-1 1520 m	Kim-2 1710 m	Kim-3 1940 m	Kim-4 2145 m	Kim-5 2520 m	Lan-1 1710 m	Lan-2 1920 m	Lan-3 2110 m	Teg-1 1345 m	Teg-2* 1535 m	Teg-3 1710 m
<i>Accipiter tachiro</i>	1 he/--	----	--/1 he	----	----	1 he/--	1 he/--	--/1 he	----	----	----
<i>Columba arquatrix</i>	----	----	----	----	----	----	----	1 si/1 si	----	----	----
<i>C. delegorguei</i>	----	----	----	1 si/1 si	----	----	----	----	1 si/1 si	1 si	----
<i>Aplopelia larvata</i>	----	--/1 si	----	----	----	----	----	----	----	----	----
<i>Tauraco livingstonii</i>	2 he/1 he	2 he/3 he	2 gr/2 gr	3 he/3 he	1 he/2 gr	1 he/4 he	2 he/3 he	2 gr/2 gr	2 gr/2 gr	2 gr	2 he/2 he
<i>Cercococcyx montanus</i>	1 si/--	----	----	----	----	----	----	----	----	----	----
<i>Strix woodfordii</i>	----	----	----	----	----	----	----	----	--/1 si	----	----
<i>Schout. myioptilus AF</i>	----	----	----	1 he/1 he	----	----	----	----	----	----	----
<i>Apaloderma vittatum</i>	----	----	1 he/1 he	2 si/2 he	----	----	--/1 si	--/1 he	1 he/1 he	2 he	1 he/--
<i>Ceratogymna brevis</i>	----	1 he/--	----	----	----	1 he/--	--/1 he	----	2 he/1 he	----	----
<i>Pogoniulus leucomystax</i>	1 he/--	1 he/1 he	--/1 he	1 he/--	----	----	1 he/1 he	--/1 he	----	----	--/1 he
<i>Smithornis capensis</i>	----	----	----	----	----	----	----	----	----	1 si	----
<i>Andropadus masukuensis</i>	1 he/--	--/1 he	--/1 si	1 he/--	----	----	----	----	----	----	----
<i>A. (t.) neumanni</i>	----	----	3 he/3 he	2 he/2 he	1 he/4 he	3 he/3 he	3 he/3 he	3 he/3 he	----	----	1 he/1 he
<i>A. olivaceiceps</i>	1 si/1 si	1 si/1 si	----	1 si/1 si	----	1 si/--	----	----	----	----	--/1 si
<i>Phyllastrephus placidus</i>	1 si/1 si	1 he/1 he	1 si/--	2 he/1 he	----	1 he/--	----	----	1 si/--	----	1 si/--
<i>Turdus (olivaceus) abyssinicus</i>	1 si/1 si	1 si/--	1 wa/1 wa	2 si/2 si	1 si/1 si	1 wa/1 wa	1 si/--	--/1 si	----	----	1 wa/--
<i>Zoothera gurneyi</i>	--/1 wa	----	----	2 si/2 si	1 si/--	1 he/--	----	----	----	----	----
<i>T. olivaceus/Z. gurneyi</i>	----	----	2 si/1 si	----	----	----	----	2 si/1 si	----	1 si	1 si/--
<i>Alethe fuelleborni</i>	1 si/--	1 si/--	----	----	----	----	1 si/--	----	1 si/1 si	----	1 si/1 si
<i>Pogonocichla stellata</i>	1 si/1 si	1 si/1 si	1 he/--	1 ca/1 ca	----	1 he/1 he	1 si/1 he	--/1 si	1 he/1 he	----	1 he/--
<i>Sheppardia sharpei</i>	----	----	----	----	----	----	----	----	--/1 si	----	----
<i>Cossypha anomala</i>	----	----	1 si/1 si	1 si/--	1 si/2 si	----	----	1 si/--	----	----	----
<i>Bradypterus mariae</i>	1 si/1 si	----	1 si/1 si	----	2 si/1 si	2 si/2 si	----	1 si/2 si	1 si/1 si	1 si	----
<i>B. cinnamomeus NF</i>	----	----	----	----	1 si/1 si	----	----	----	----	----	----
<i>Bathmocercus winifredae</i>	----	----	--/1 pa	----	----	1 si/2 si	----	----	----	----	----
<i>Phylloscopus umbrovirens</i>	----	----	----	----	1 si/1 si	----	----	----	----	----	----
<i>P. ruficapillus</i>	1 he/1 he	1 si/2 si	----	1 he/--	----	1 si/1 si	1 si/1 he	2 si/1 si	----	1 si	1 si/1 si
<i>Apalis thoracica</i>	----	----	1 pa/1 pa	2 si/2 si	1 si/1 pa	1 si/2 si	--/1 si	1 si/--	----	----	1 he/--
<i>A. chapini</i>	----	1 si/2 si	1 si/1 si	2 si/1 si	----	----	----	1 si/1 si	----	----	1 si/--
<i>Orthotomus metopias</i>	----	----	--/1 pa	--/1 si	----	1 si/2 si	----	--/1 si	1 si/--	----	----

Table 5.10. Tape recordings at dawn.	Number of birds audible (morning 1/morning 2)										
	Kim-1 1520 m	Kim-2 1710 m	Kim-3 1940 m	Kim-4 2145 m	Kim-5 2520 m	Lan-1 1710 m	Lan-2 1920 m	Lan-3 2110 m	Teg-1 1345 m	Teg-2* 1535 m	Teg-3 1710 m
<i>Camaroptera brachyura</i>	1 wa/--	---	---	---	---	---	---	---	1 si/1 si	---	---
<i>Muscicapa adusta</i>	---	---	---	---	---	1 he/--	---	---	---	---	---
<i>Batis mixta</i>	1 he/--	---	--/1 pa	--/1 he	---	1 he/1 he	1 he/2 si	1 pa/1 pa	1 he/--	---	---
<i>Trochocercus albonotatus</i>	2 si/2 si	1 ca/2 si	1 he/1 he	2 he/2 he	1 he/1 he	1 he/2 si	1 si/2 si	---	---	---	--/1 he
<i>Terpsiphone viridis</i>	1 si/--	1 he/--	---	1 he/--	---	2 he/1 he	--/1 si	--/1 he	---	1 si	---
<i>Modulatrix stictigula</i>	---	2 si/2 si	2 si/1 si	2 si/2 ca	1 si/1 si	1 ca/--	2 si/1 he	1 si/--	1 si/--	1 he	1 si/1 si
<i>Alcippe abyssinica</i>	---	---	---	---	---	--/1 he	---	1 si/1 si	---	---	---
<i>Nectarinia loveridgei</i>	1 si/--	1 si/2 si	1 si/1 si	1 si/--	---	1 si/1 si	--/1 si	---	---	---	1 si/--
<i>Zosterops senegalensis</i>	1 he/2 si	1 si/1 si	---	1 he/2 si	---	---	---	--/1 si	---	---	---
<i>Laniarius fuelleborni</i>	---	---	1 he/--	---	---	---	---	--/1 he	---	---	1 he/--
<i>Telophorus nigrifrons</i>	---	---	---	---	---	---	---	---	---	1 he	1 he/--
<i>Dicrurus ludwigii</i>	---	---	---	---	---	---	---	---	1 he/--	---	---
<i>Onychognathus walleri</i>	---	---	--/1 he	---	---	--/2 si	---	1 he/1 he	---	---	---
<i>Cryptospiza reichenovii</i>	---	---	---	---	---	---	---	---	---	---	---
Unidentified birds	---	---	---	---	---	---	---	---	---	---	1 he/1 he
Forest species (-AF)	19	17	22	22	10	21	16	22	15	10*	19
AF forest species	0	0	0	1	0	0	0	0	0	0	0
Non-forest species	0	0	0	0	1	0	0	0	0	0	0

Table 5.10. Tape recordings at dawn. Number of birds audible. Each tape recording was of a duration of 30 minutes.

si= Singing.

pa= Pair singing.

ca= Calling.

wa= Warning.

he= Heard (if we do not know whether it is song, call or the like).

gr= Groups (turacos are often calling groupwise).

--= None heard.

* = At Tegetero 1535 m only one tape recording was made, due to technical problems.

NF: Non-forest species.

AF: Aerial feeding forest species.

Table 5.11. Mistnetting D, Kimboza F.R.

Table 5.11. Mistnetting D.	Number of individuals mistnetted.
<i>Apaloderma narina</i>	1
<i>Phyllastrephus terrestris</i>	1
<i>Cossypha natalensis</i>	7
<i>Neocossyphus rufus</i>	2
<i>Alethe fuelleborni</i>	2
<i>Trochocercus cyanomelas</i>	2
<i>Illadopsis rufipennis</i>	2
<i>Nectarinia olivacea</i>	1
<i>Mandingoa nitidula</i>	1
Total	19

Table 5.11. Mistnetting D. Number of birds mistnetted in the lowland Kimboza F.R. during our survey.

Table 5.12. Mistnetting E, Kigurunyembe.

Table 5.12. Mistnetting E.	Number of individuals mistnetted
<i>Phyllastrephus cerviniventris</i>	2
<i>Cossypha natalensis</i>	4
<i>Cercotrichas quadrivirgata NF</i>	1
<i>Camaroptera brachyura</i>	1
<i>Trochocercus cyanomelas</i>	1
<i>Terpsiphone viridis</i>	1
<i>Anthreptes collaris NF</i>	1
<i>Nectarinia olivacea</i>	1
<i>Hypargos niveoguttatus</i>	2
Sum	14

Table 5.12. Mistnetting E. Number of birds mistnetted in the forest strip at Kigurunyembe during our survey.

Figures, Section 5 (Ornithology)

Figures 5.1a-m (below). Relative abundance (ranked) of bird species at the 13 surveyed stations

For all diagrams: species with equal scores are presented in taxonomical sequence.

- *Mistnetting for two full days (upper diagram)*: A graphic presentation of the data from Table 5.7 (but numbers mistnetted per station has been standardised to “per hundred”). We have chosen to show a diagram also for Kimhandu-6 (1540 m) despite that we mistnetted only for 13.5 hours.
- *One-hectare plots (lower diagram)*: A graphic presentation of the data from Table 5.9
- *Comparability of upper and lower diagrams*: For a given station the “rank” of the species in order of commonness can be compared between the upper and the lower diagrams with some caution. Certain problems of methodology and data presentation are discussed in Appendix 5.12

Abbreviations and terms:

Th: Globally Threatened

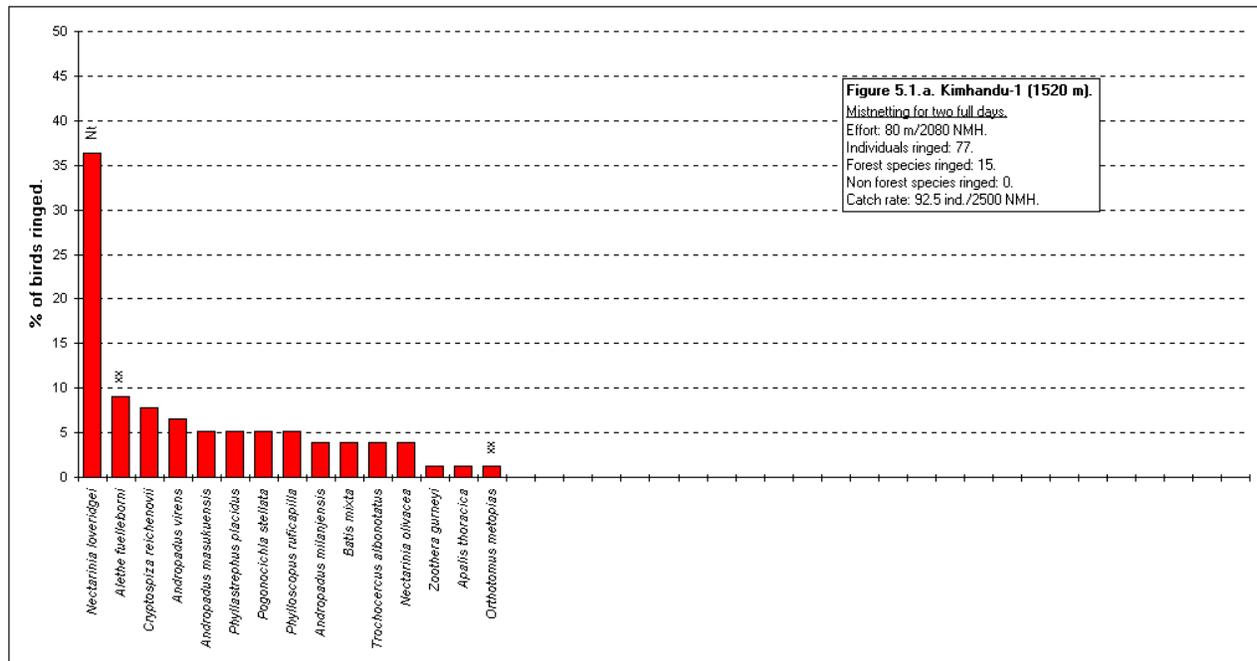
Nt: Globally Near-threatened

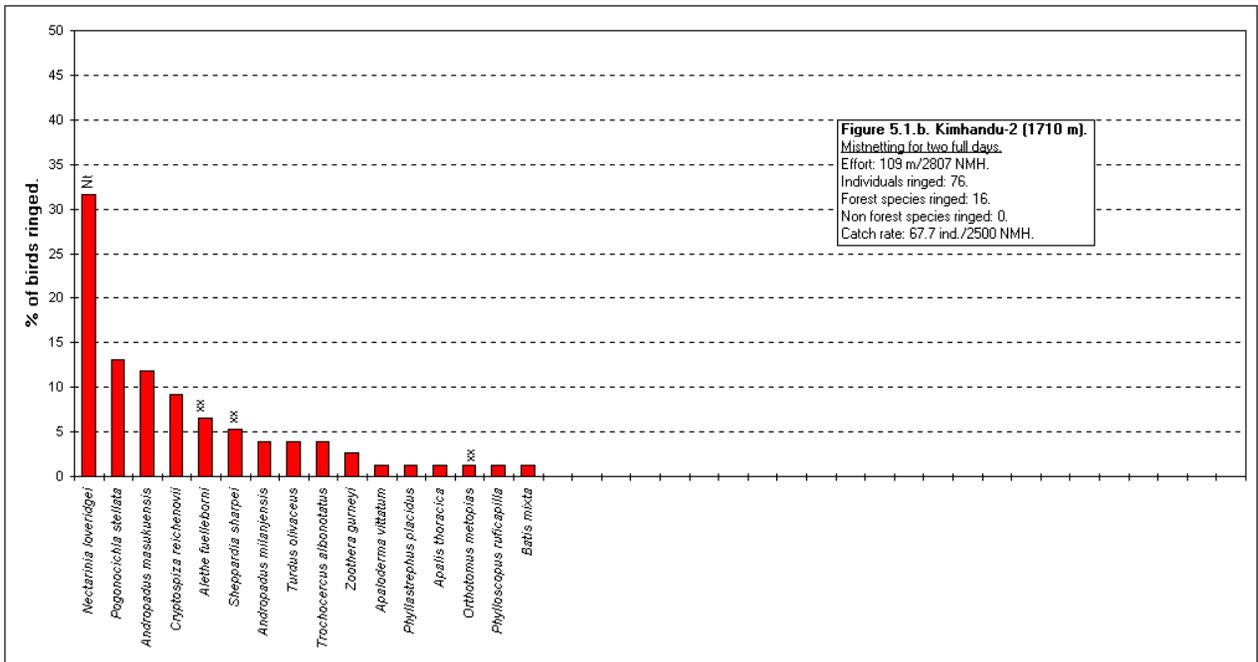
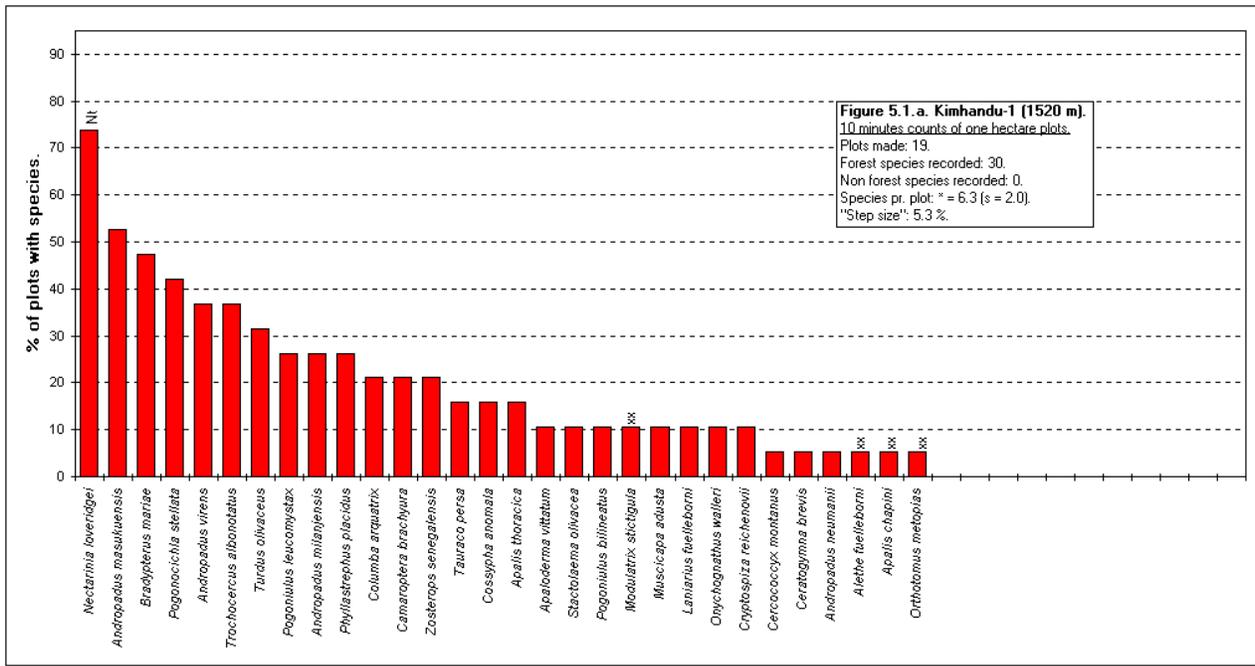
xx: Of restricted range but not Threatened or Near-threatened

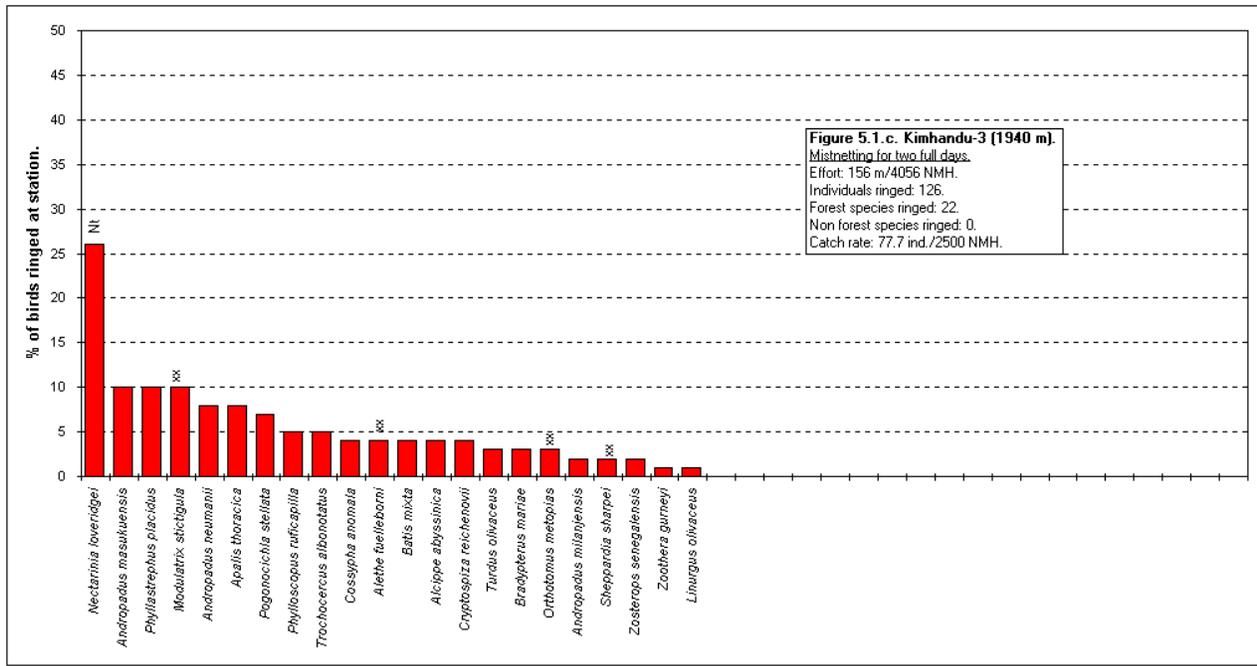
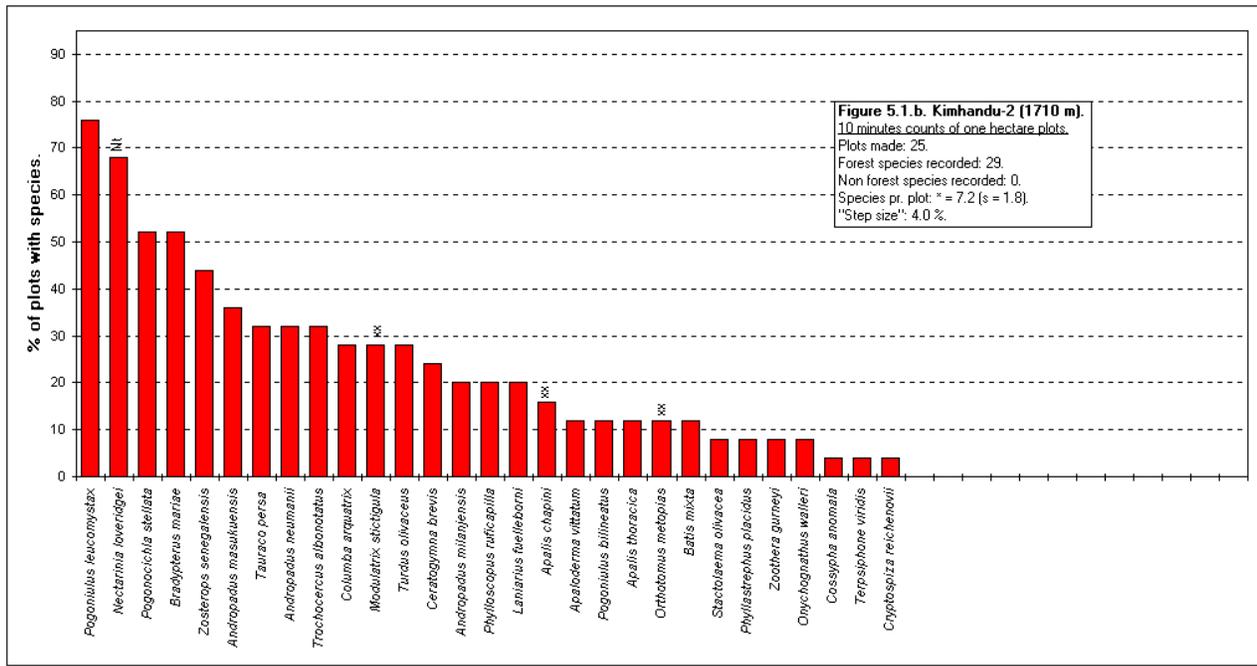
NF: Non-forest species

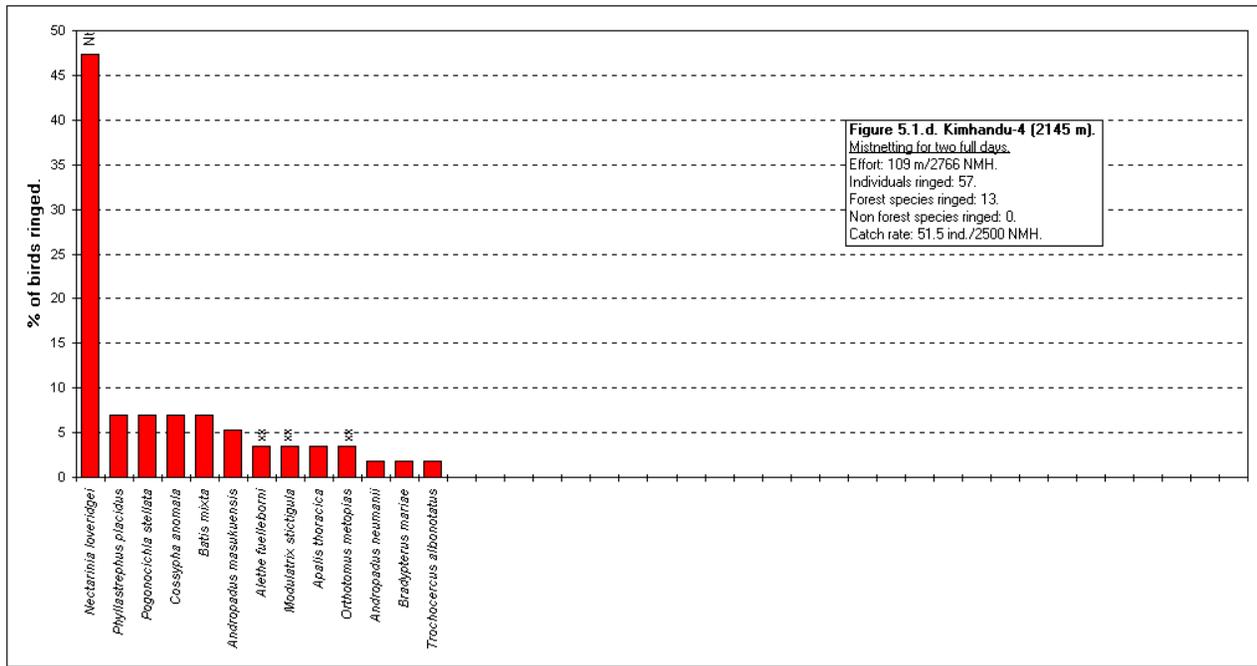
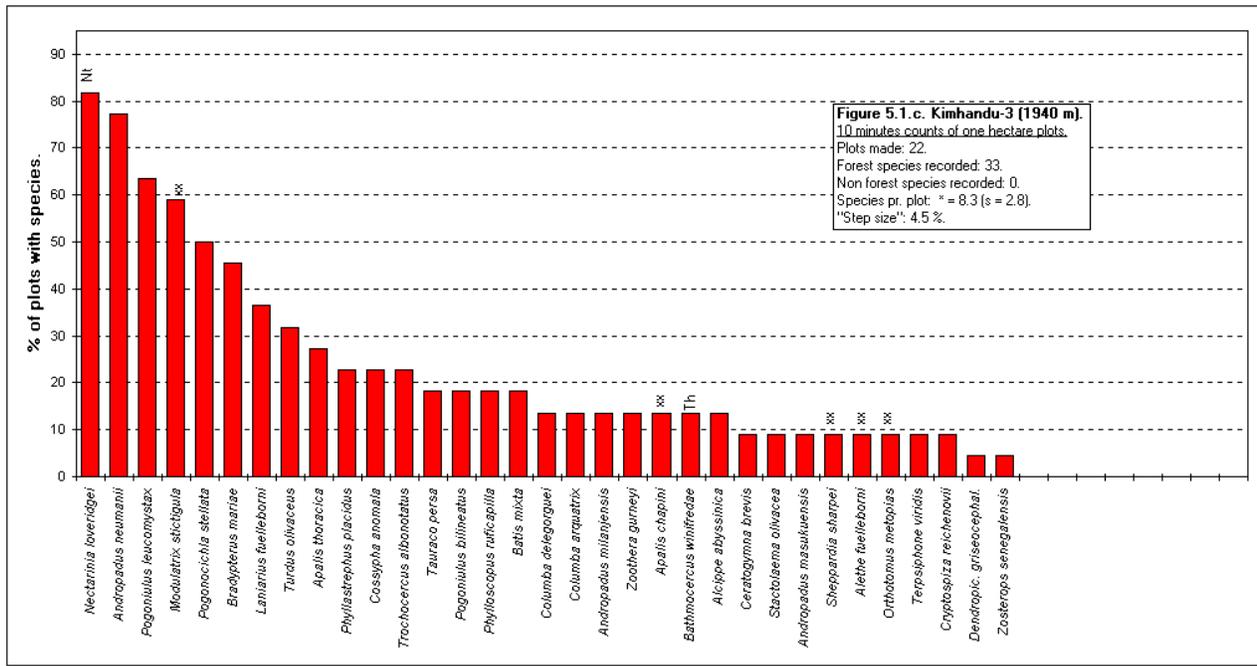
AF: Aerial feeding (forest) species

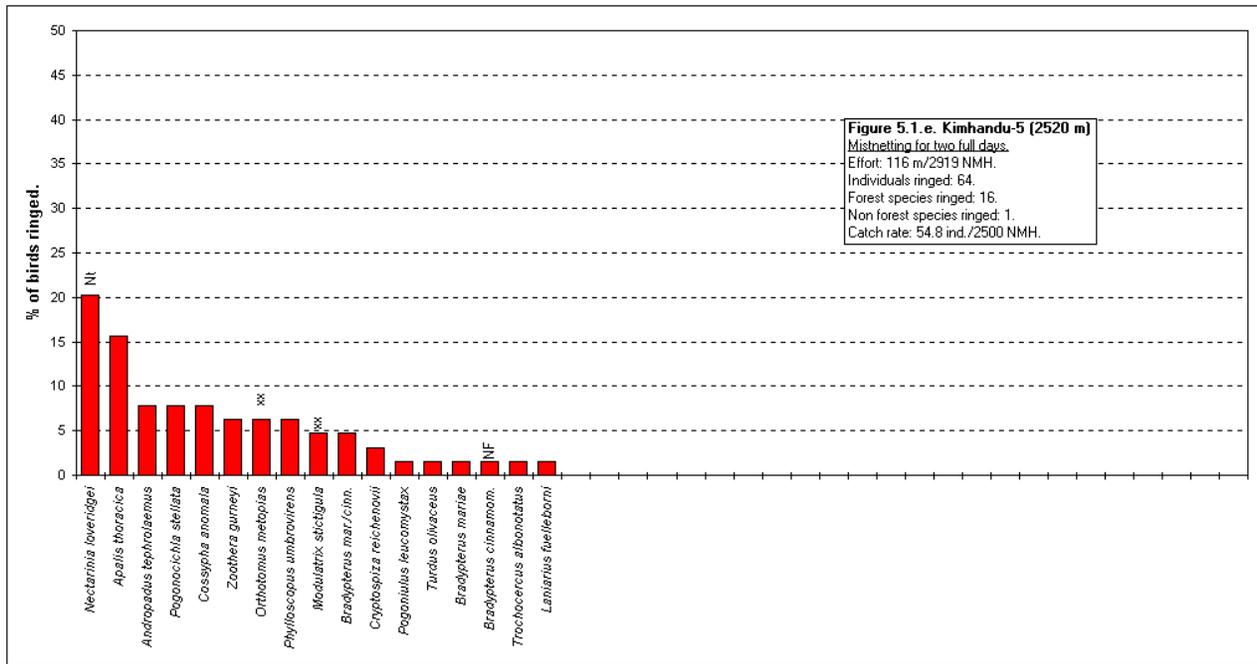
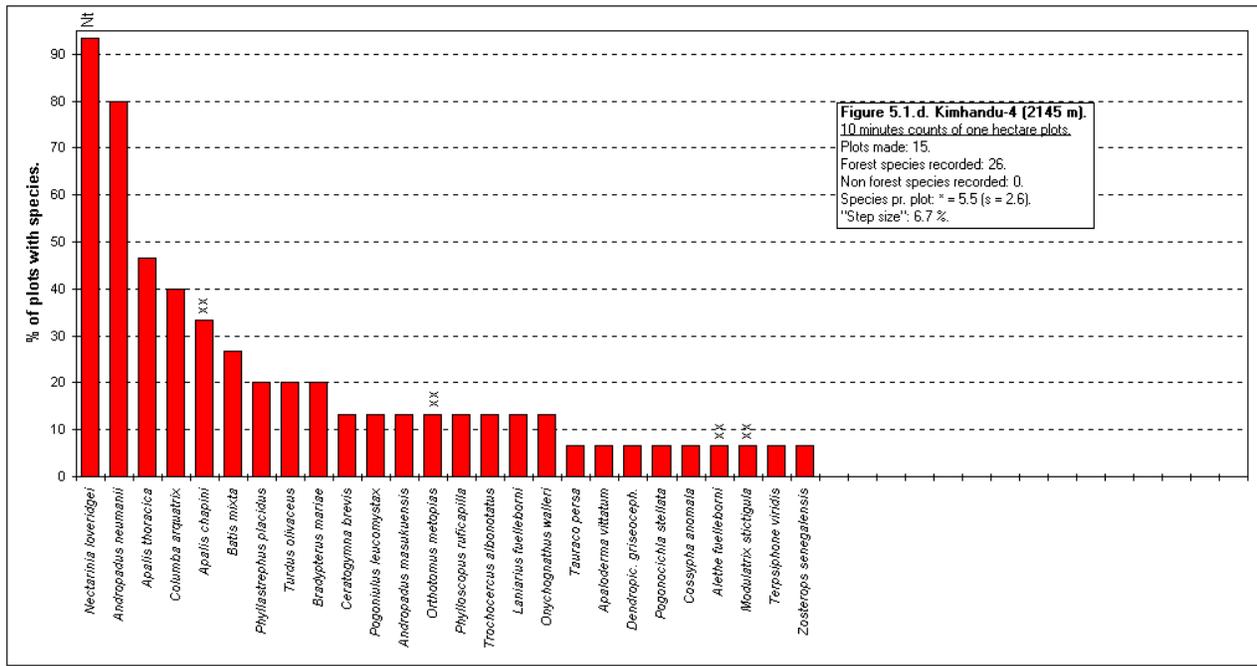
Step size: Defined as the reciprocal value of the number of plots made (example: 25 plots give a step size of 25 %)

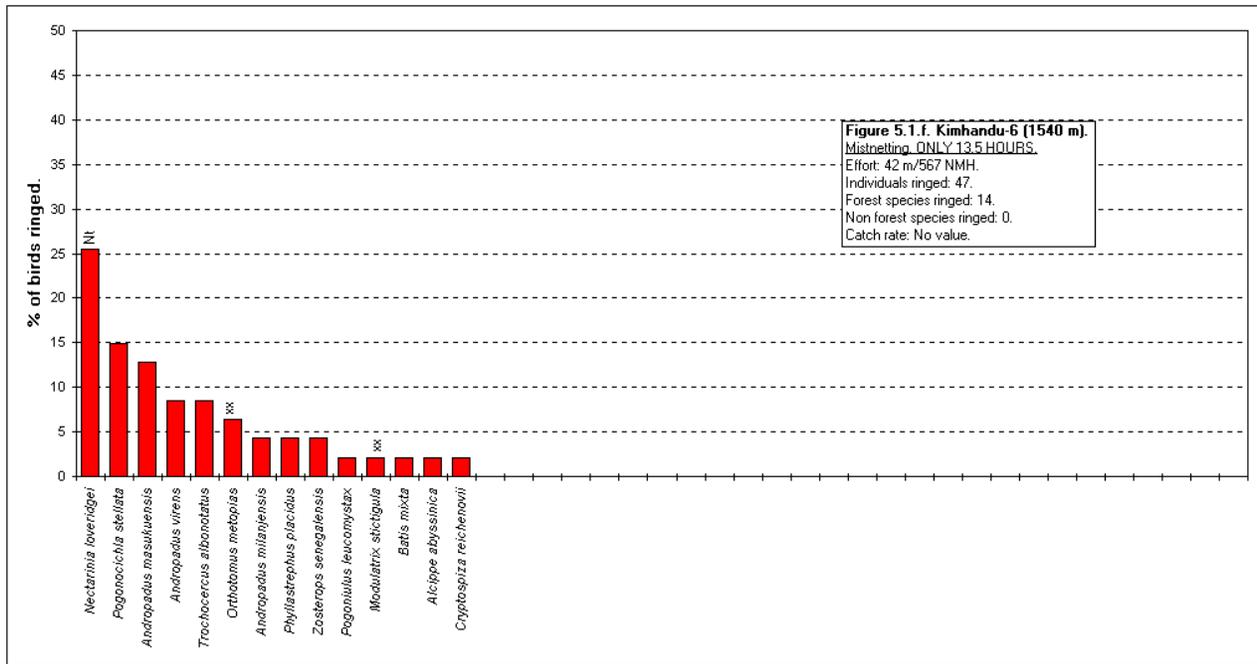
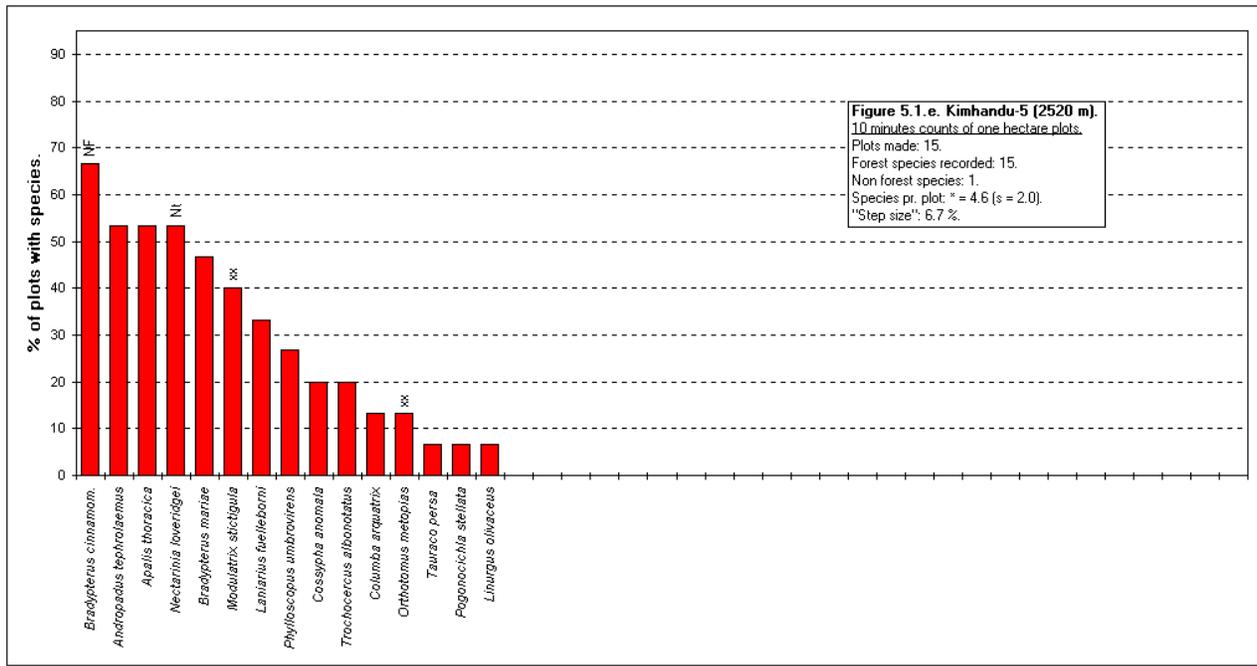


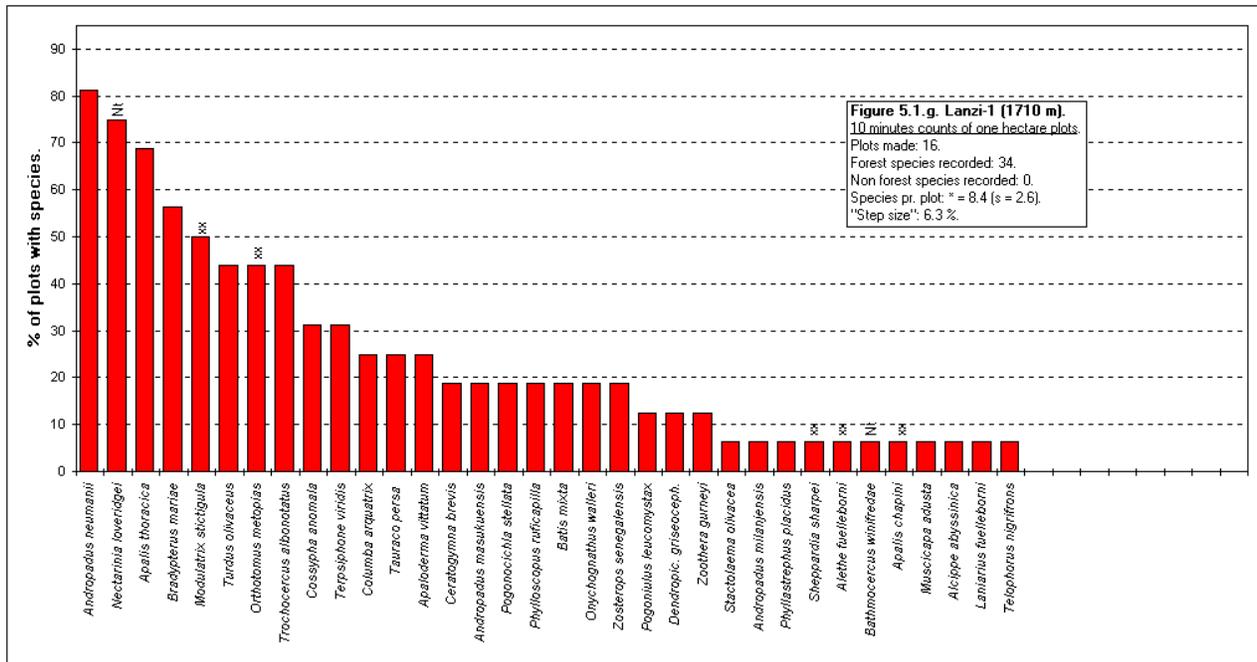
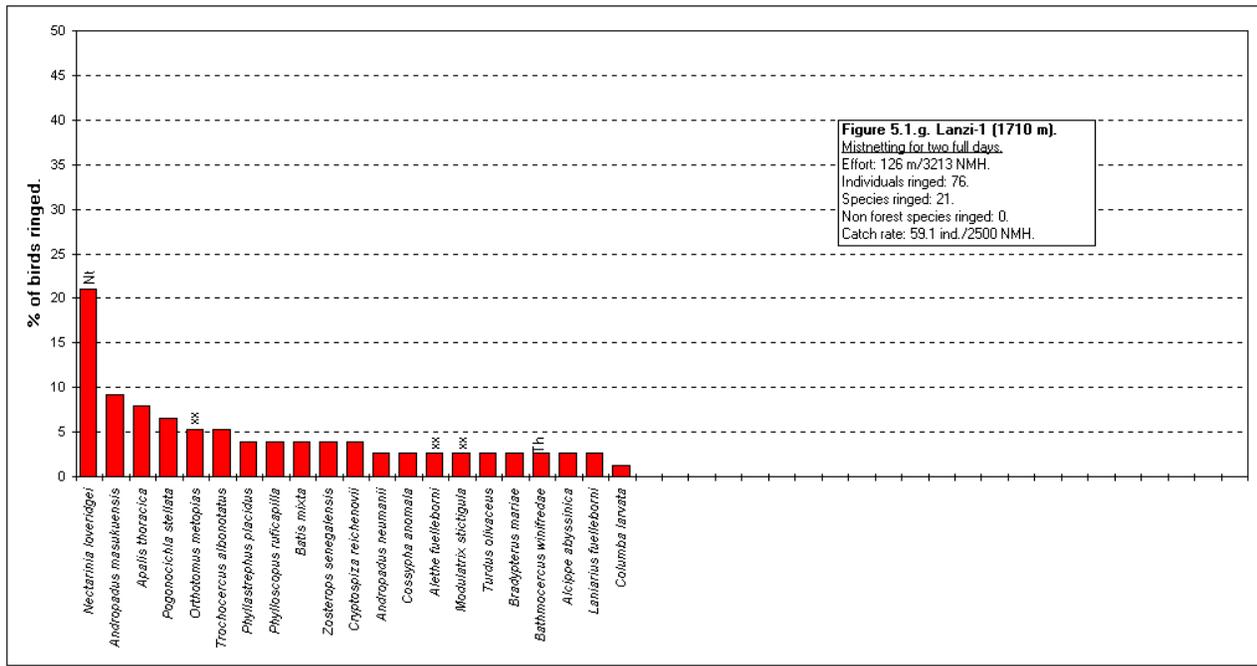


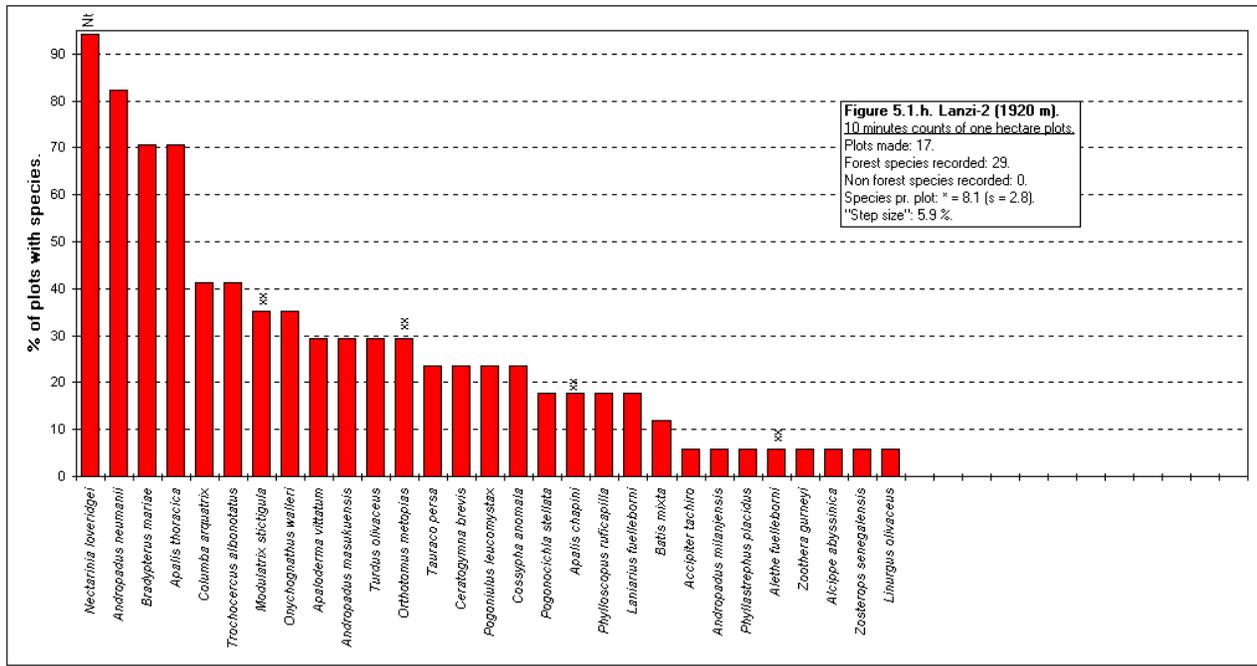
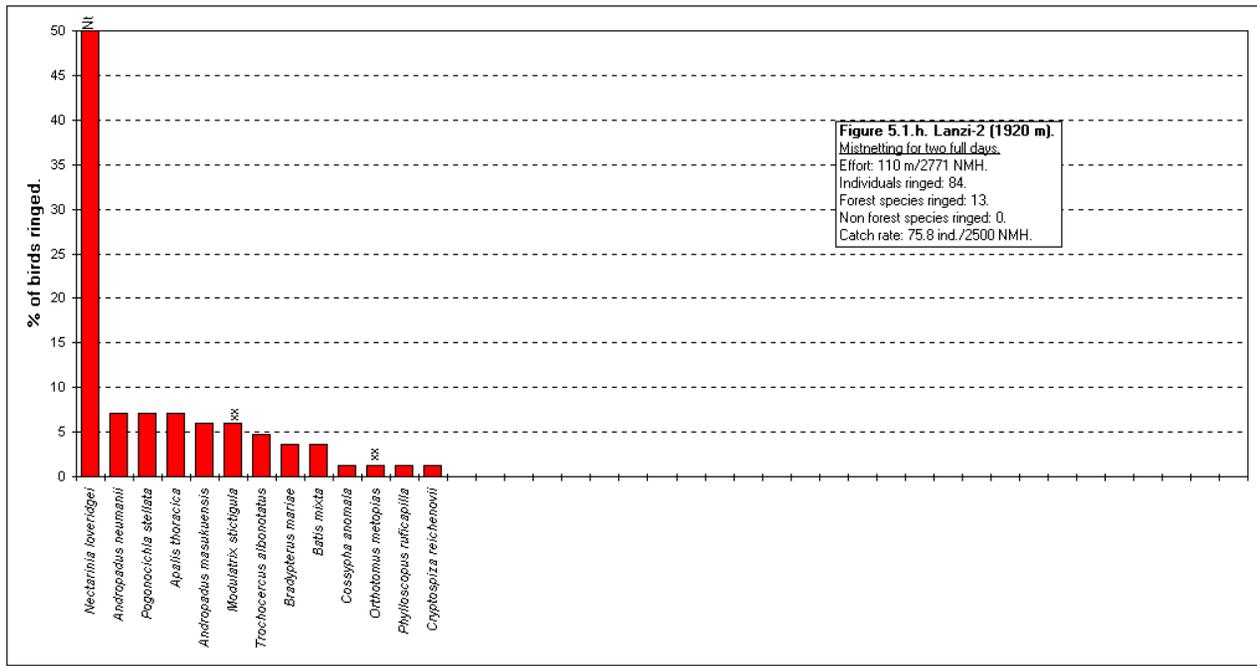


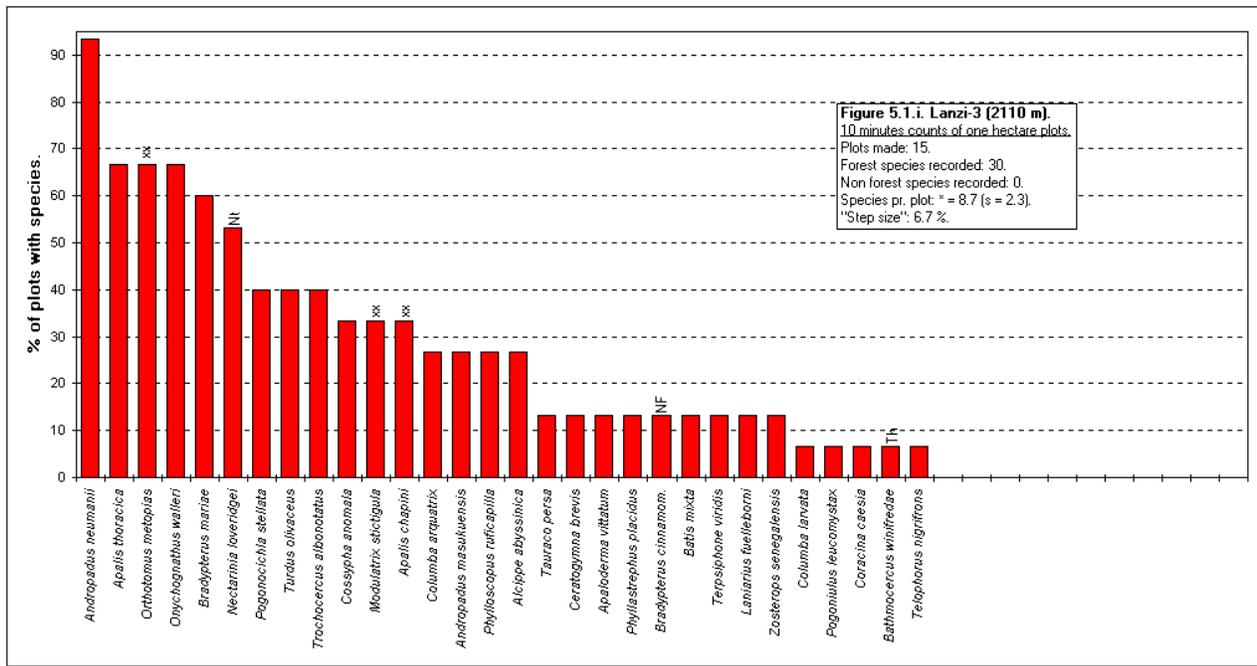
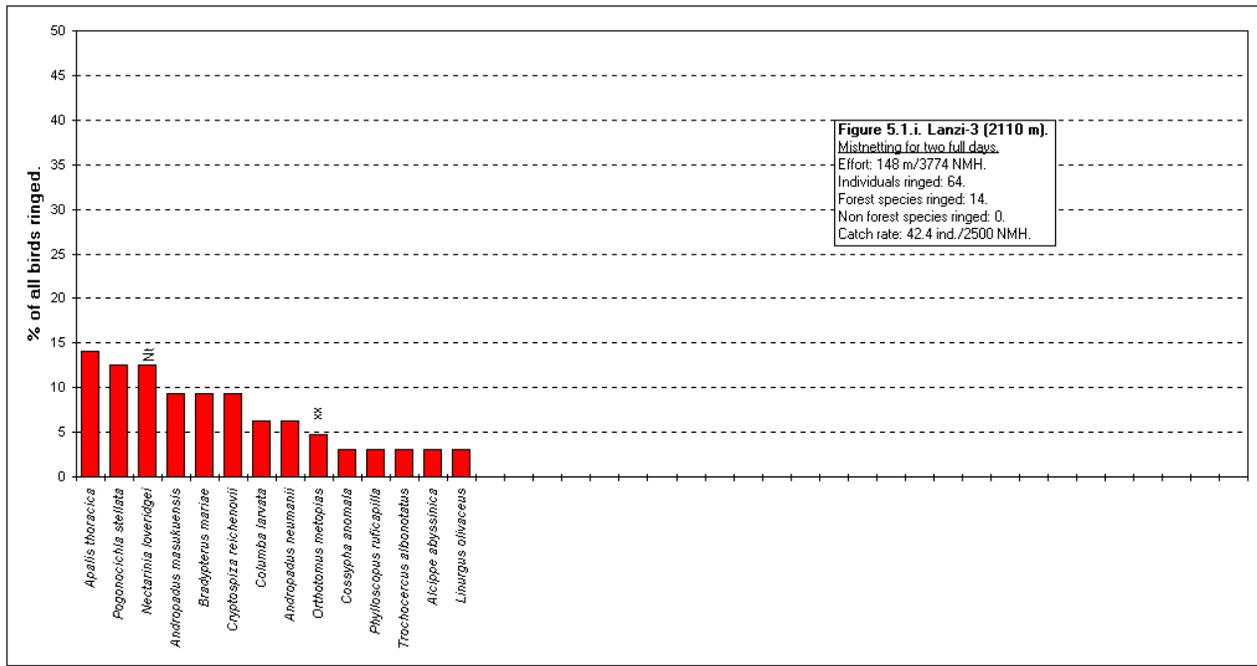


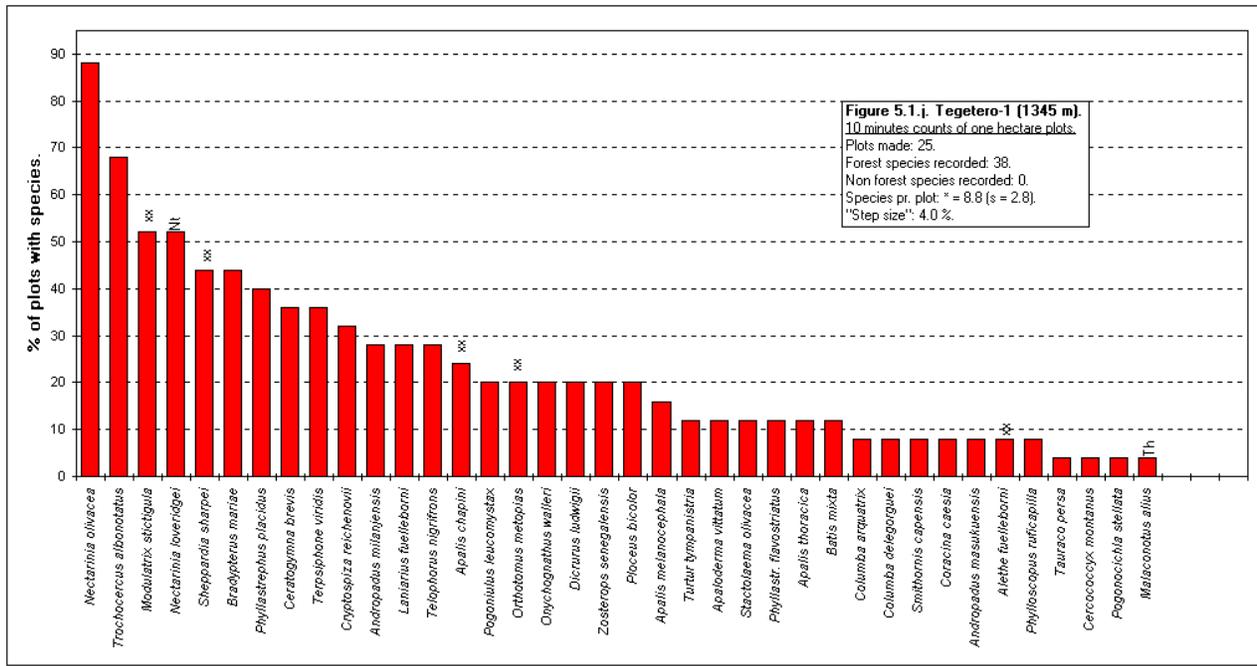
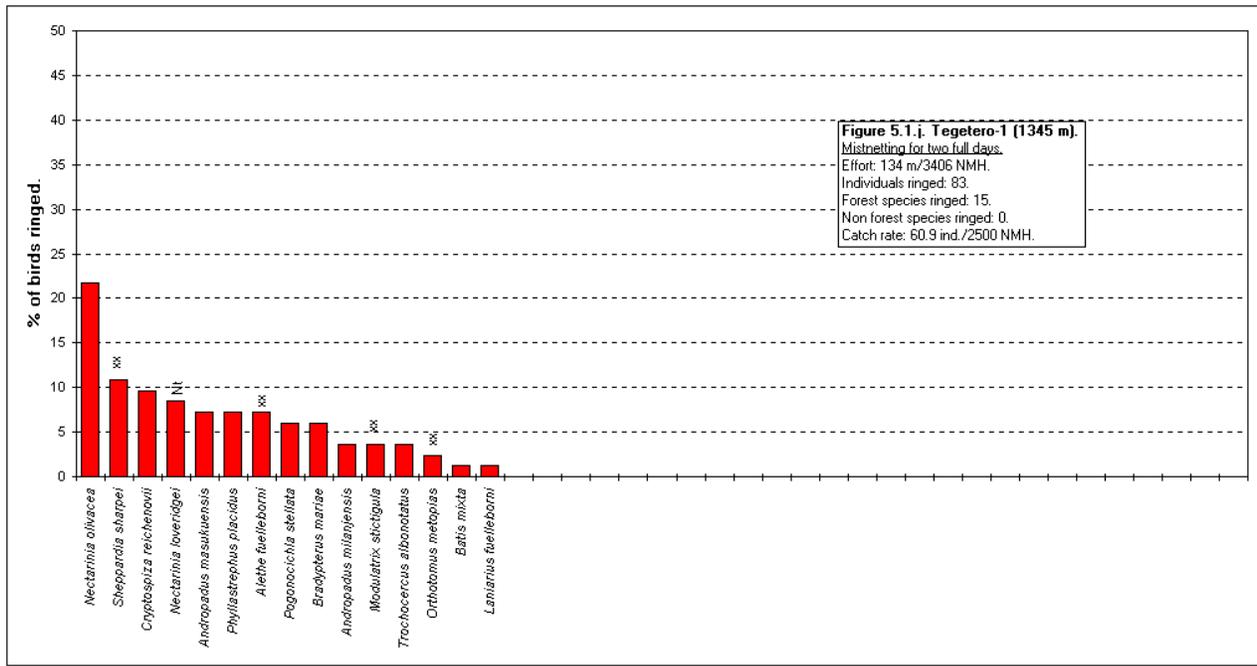


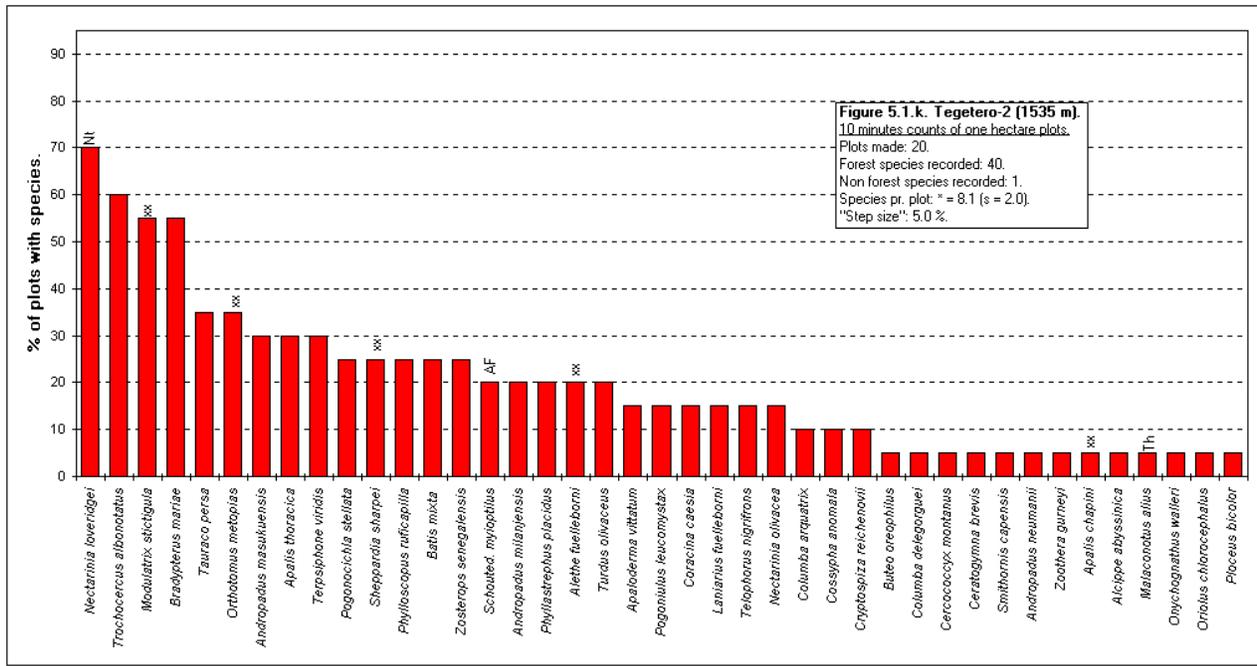
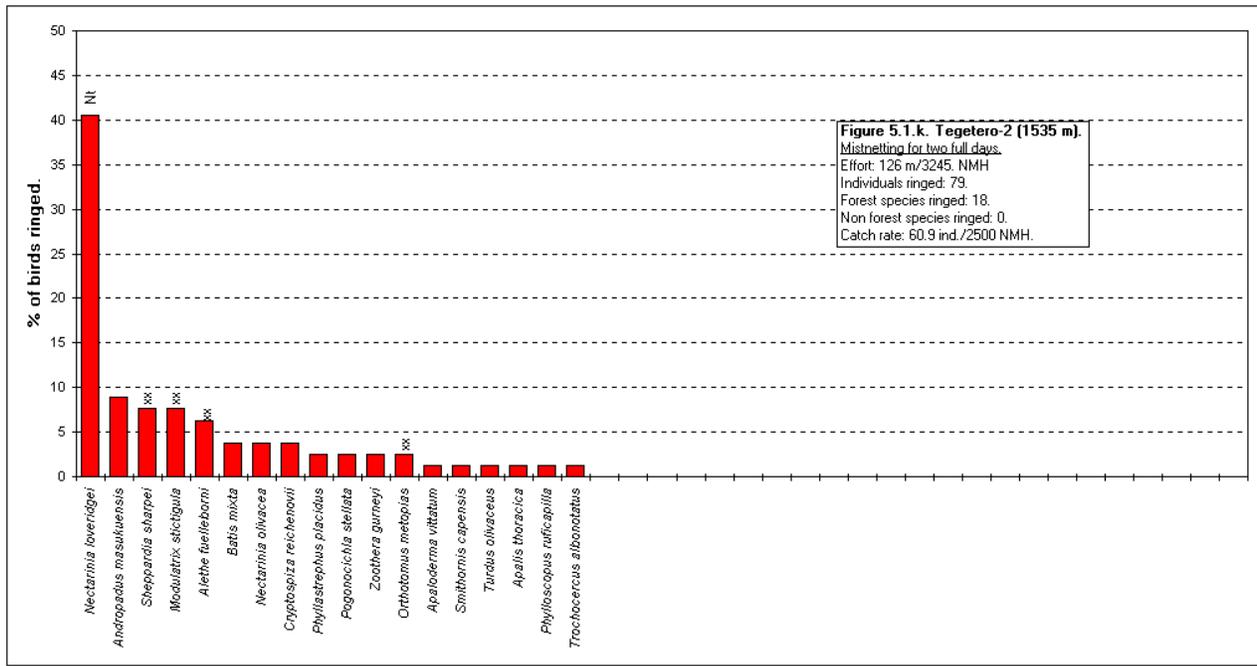


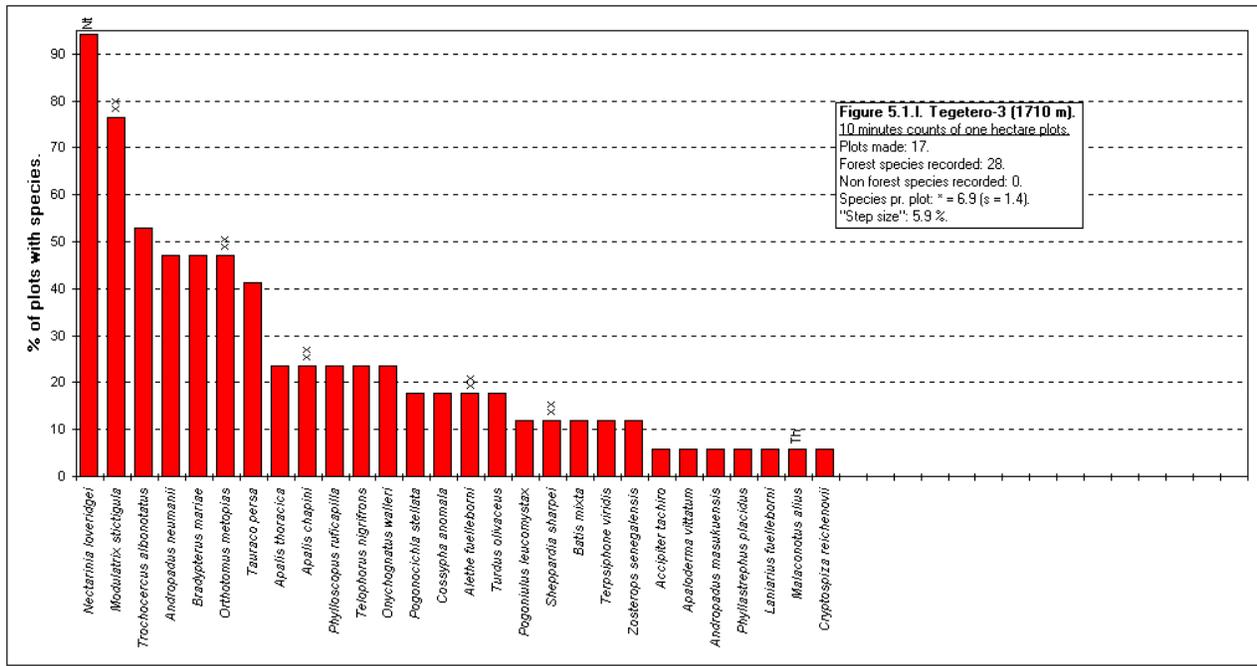
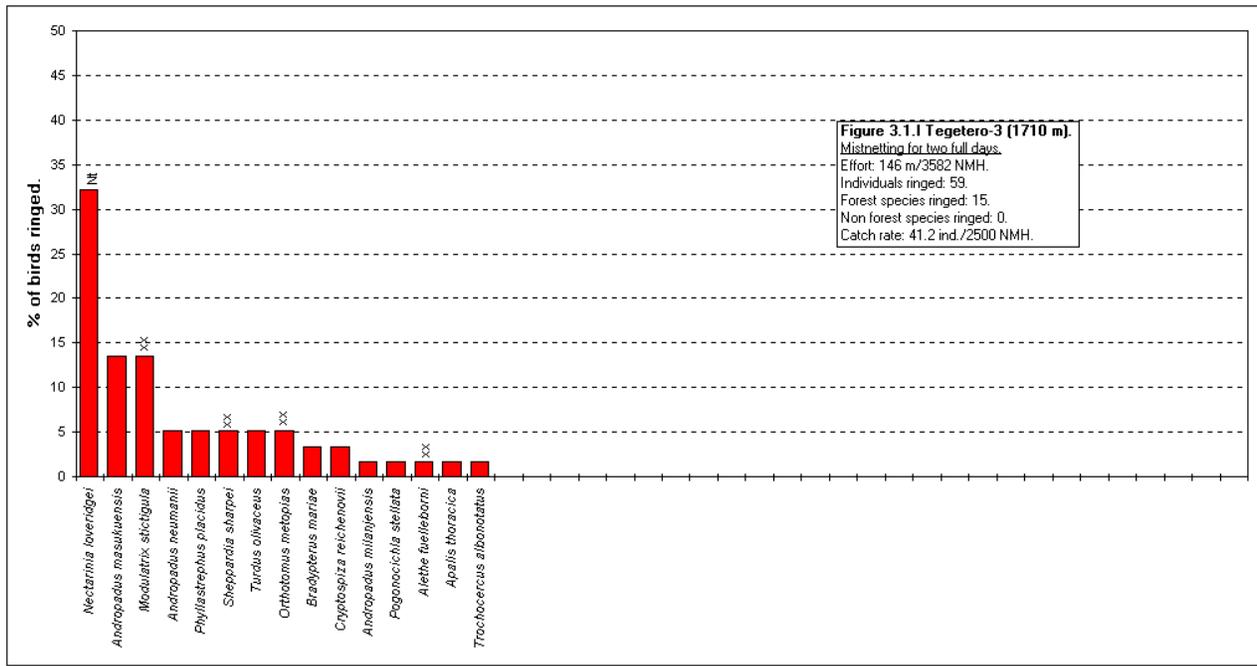


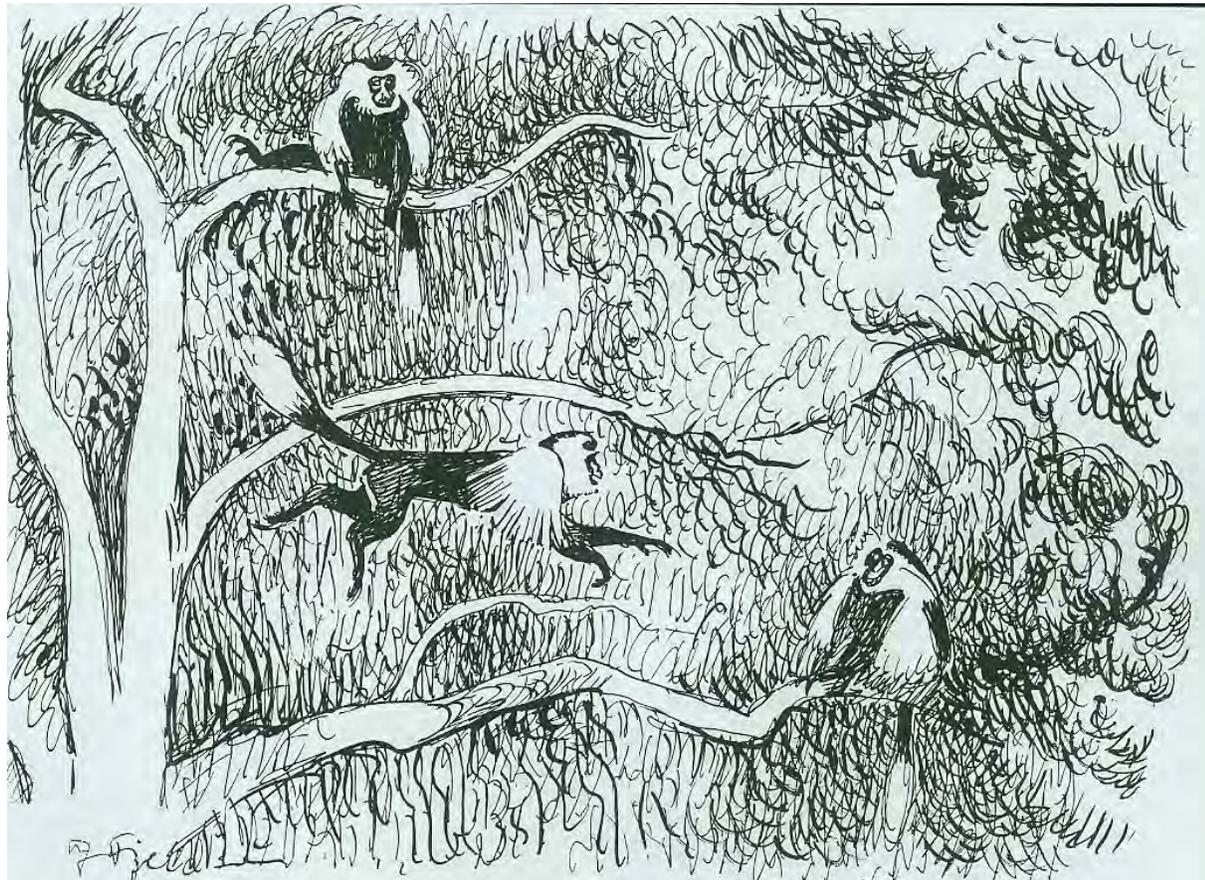
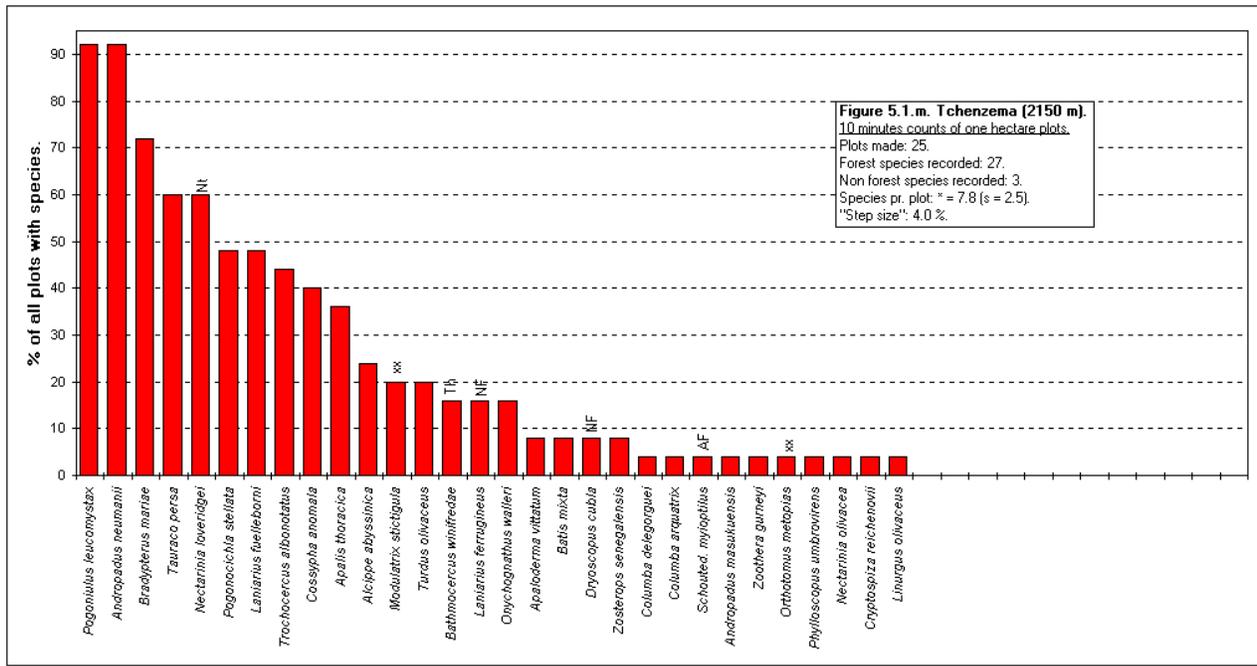






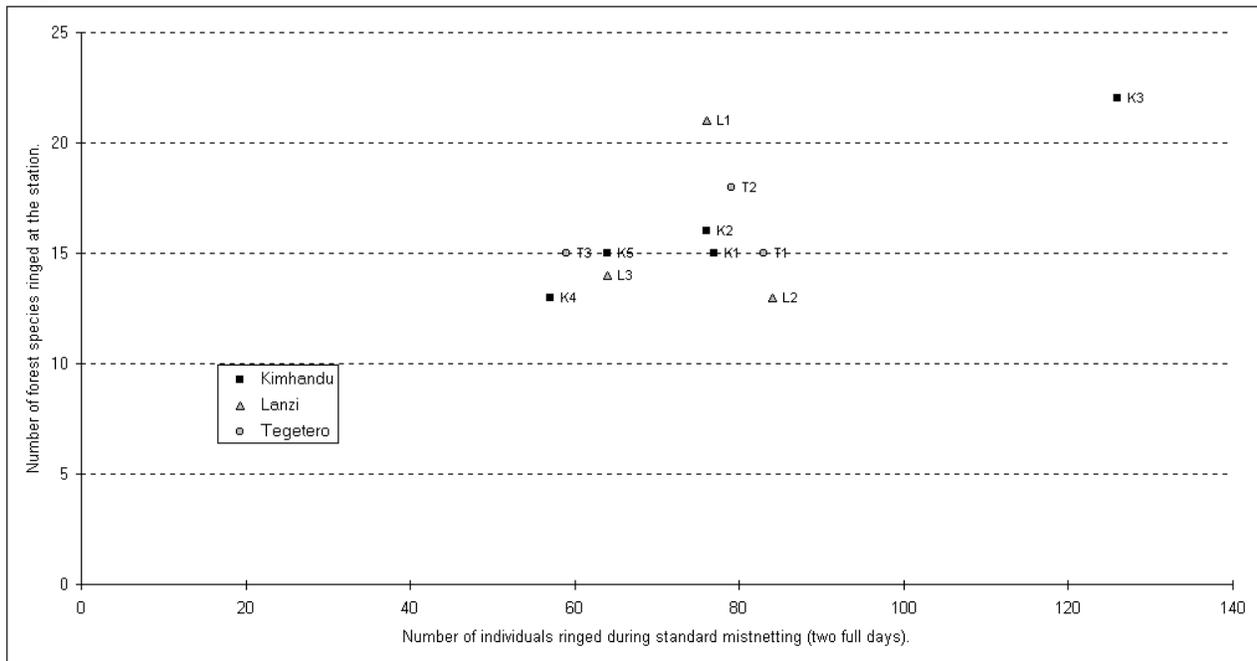






Drawing: Jon Fjeldså

Figure 5.2. Number of forest bird species ringed per station towards number of individuals ringed. Data are from Table 5.7.



Note: No standard mistnetting was performed at Kimhandu 1540 (K6)

Figure 5.3. Number of forest bird species recorded per station on plots towards number of plots assessed. Data are from Table 5.9.

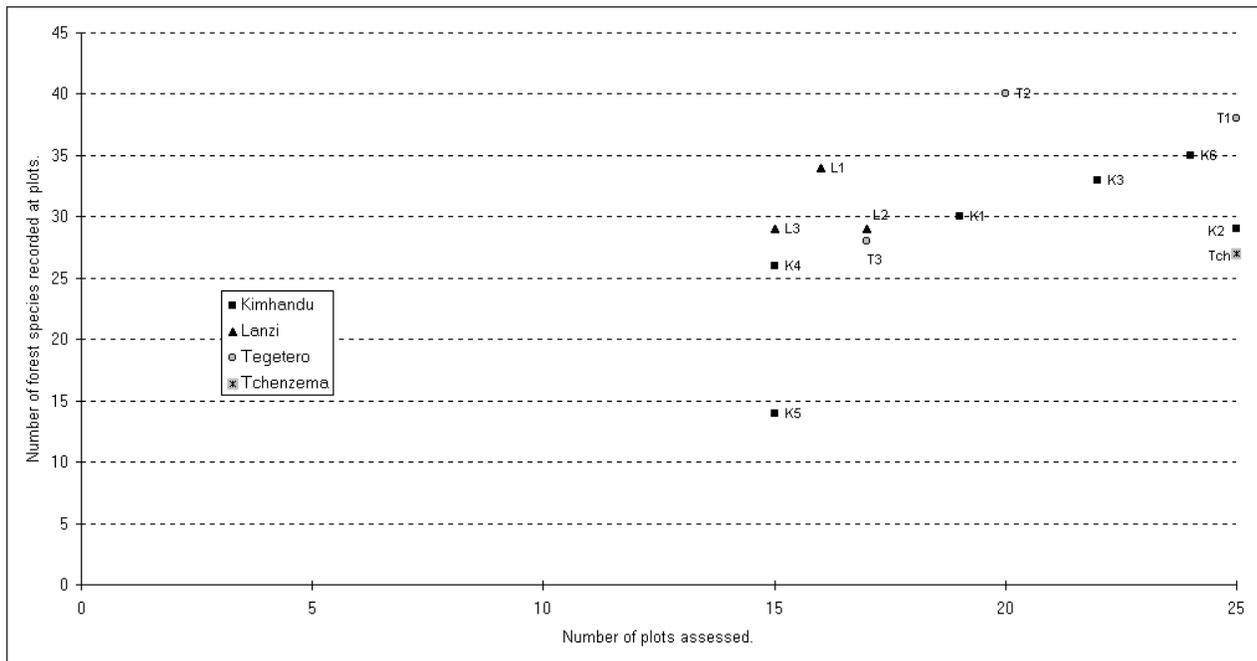
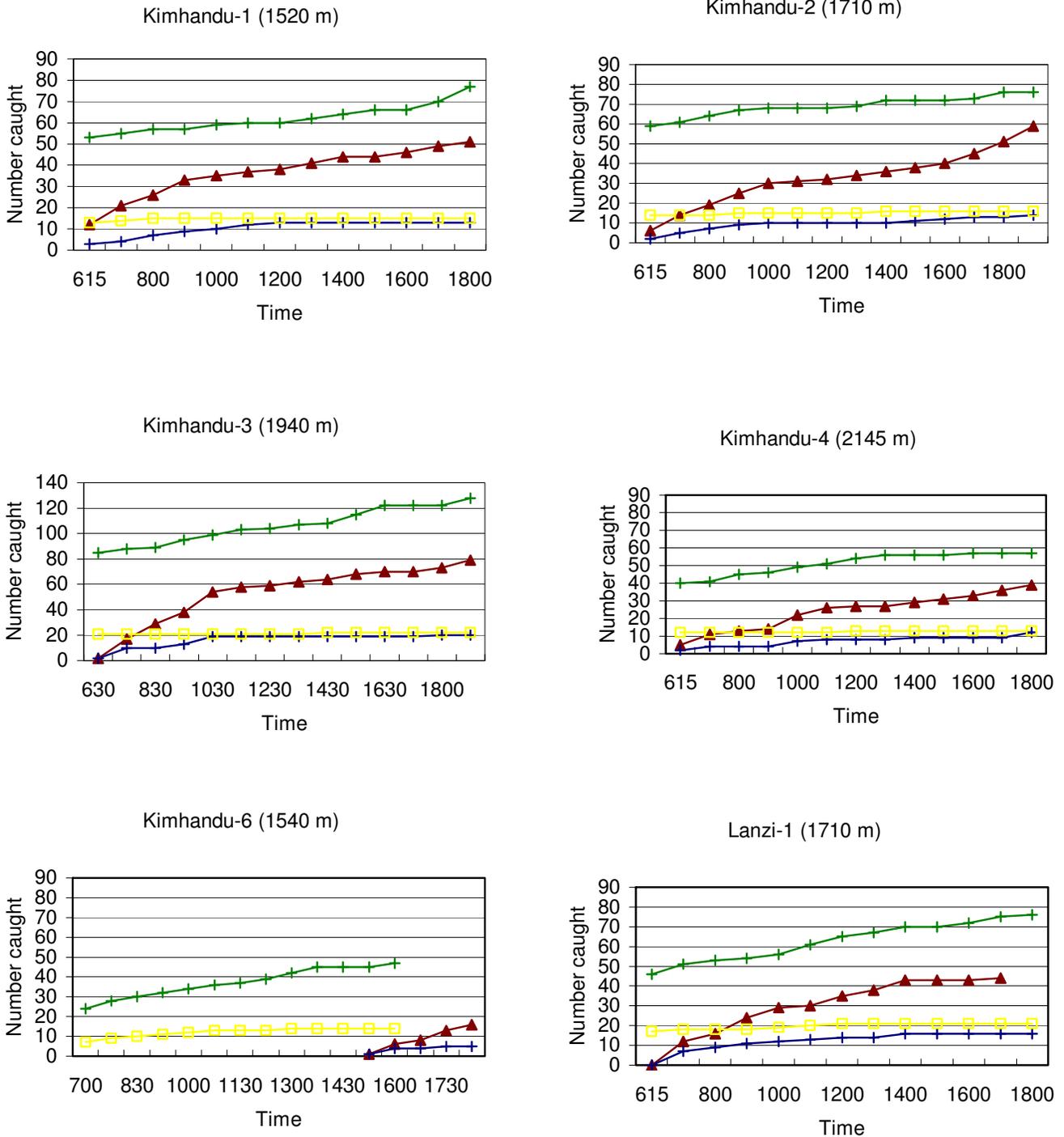
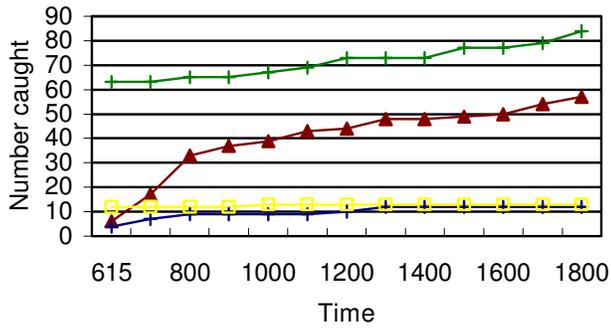


Figure 5.4. (Below) Species accumulation curves for mistnetting and plots assessments.

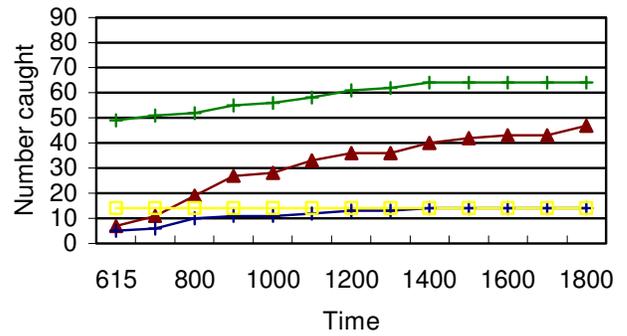
Mistnetting-data: The data are for mistnetting for two full days (individuals included in Table 5.7, except for the Kimhandu-6 station). The two lower curves (on all diagrams) show the cumulative number of species (asterisks: first day of mistnetting; empty square: second day of mistnetting). The upper curves (on all diagrams) show cumulative number of individuals caught (filled triangles: first day of mistnetting; pluses: second day of mistnetting).



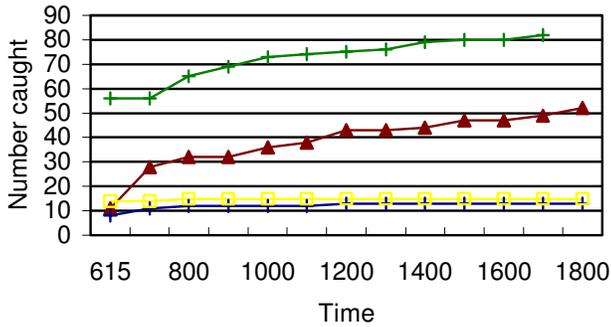
Lanzi-2 (1920 m)



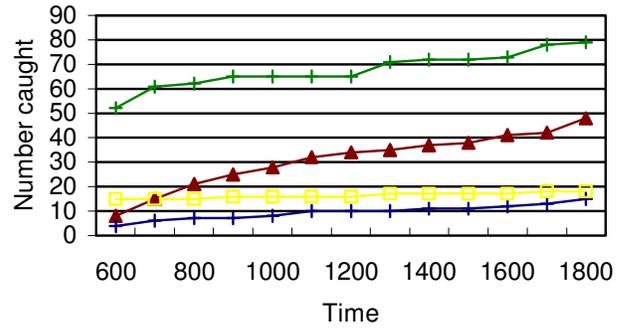
Lanzi-3 (2110 m)



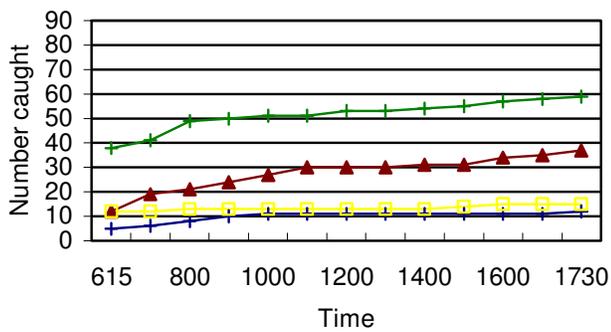
Tegetero-1 (1345 m)



Tegetero-2 (1535 m)

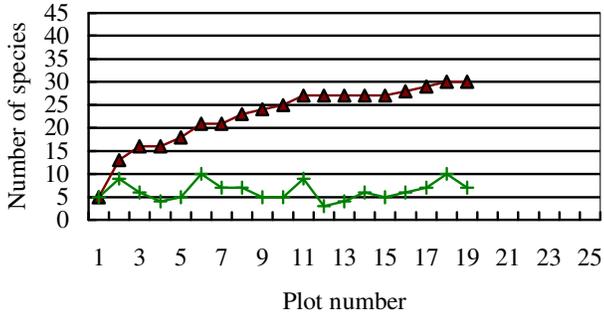


Tegetero-3 (1710 m)

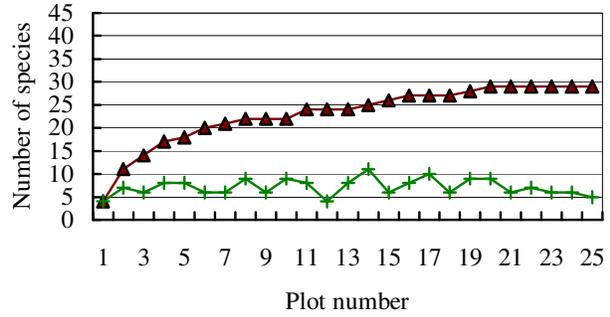


Plot-data: The lower curve (pluses, on all diagrams) shows the number of species recorded at the single plot. The upper curve (filled triangles, on all diagrams) shows the total number of species recorded on the plots. All species mentioned in Table 5.9 are included.

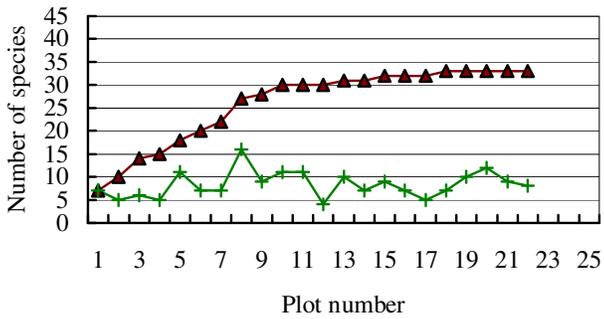
Kimhandu-1 (1520 m)



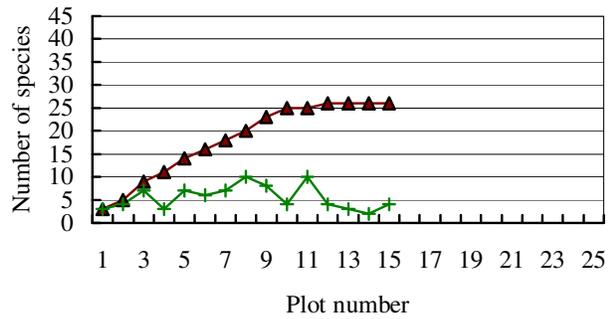
Kimhandu-2 (1710 m)



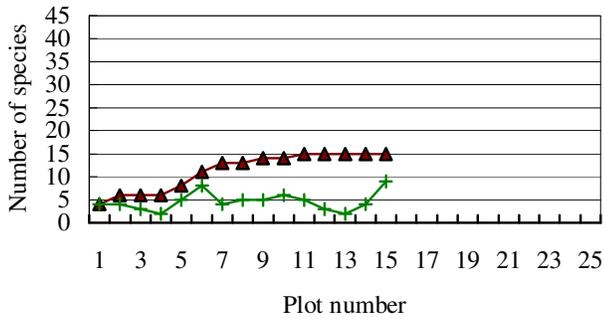
Kimhandu-3 (1940 m)



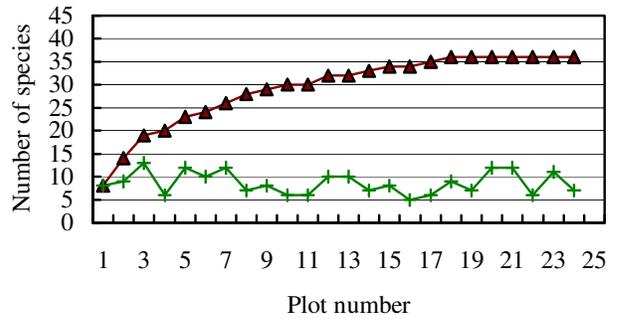
Kimhandu-4 (2140 m)



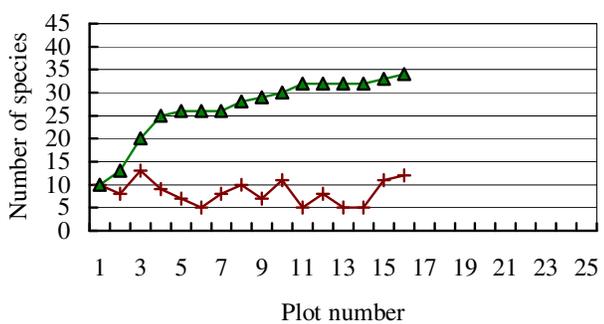
Kimhandu-5 (2520 m)



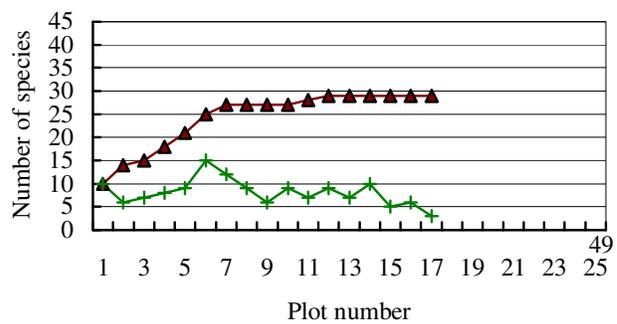
Kimhandu-6 (1540 m)



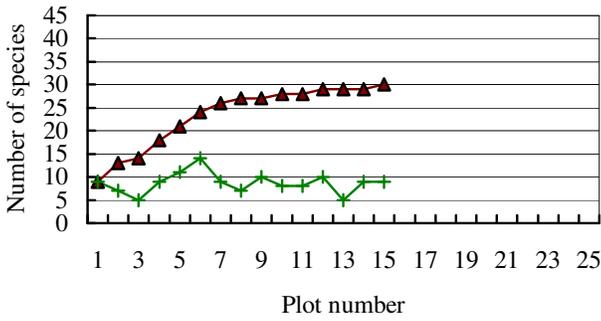
Lanzi-1 (1710 m)



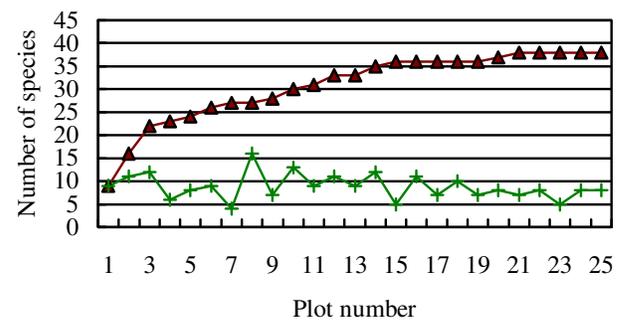
Lanzi-2 (1920 m)



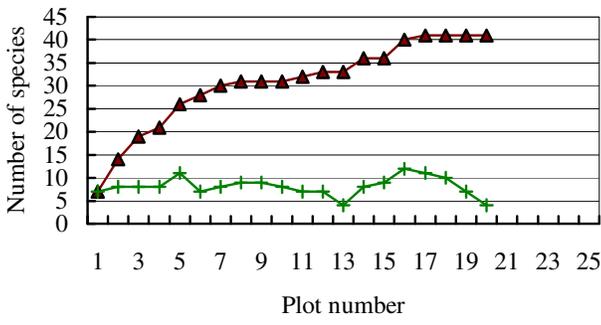
Lanzi-3 (2110 m)



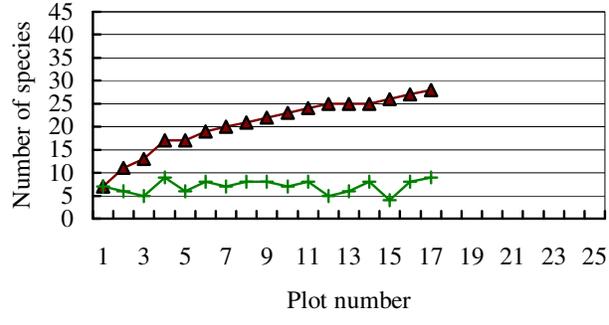
Tegetero-1 (1345 m)



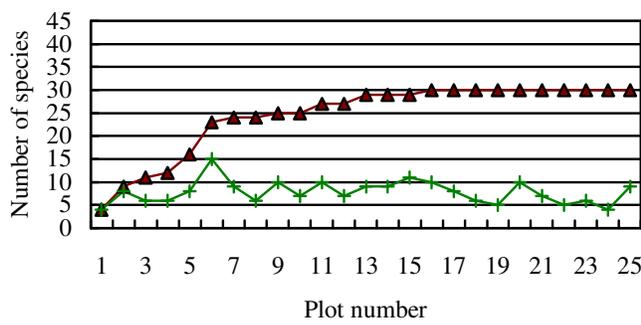
Tegetero-2 (1535 m)



Tegetero-3 (1710 m)



Tchenzema (2150 m)



Plot-data: The lower curve (pluses, on all diagrams) shows the number of species recorded at the single plot. The upper curve (filled triangles, on all diagrams) shows the total number of species recorded on the plots. All species mentioned in Table 5.9 are included.

Table 6.1. Checklist of mammals occurring in the Uluguru Mountains*.

Double underlining: Endemic to the Uluguru Mountains according to Collar and Stuart (1988).

Single underlining: Endemic to the Eastern Arc.

On the IUCN list: On the 1994 IUCN Red List of Threatened Animals (IUCN 1994). Some of these species (those with codes K and I) are not well known and although it is thought that they are probably threatened they have not been given a formal threat status by IUCN.

CITES: On the CITES list (Skov- og Naturstyrelsen 1987).

INSECTIVORA

<u><i>Chrysochloris stuhlmanni tropichalis</i></u> ^{F,G}	<u>Golden Mole</u>
<i>Crocidura bicolor</i> ^F	
<i>C. fumosa</i>	
<i>C. gracilipes</i>	
<i>C. hirta</i>	
<i>C. (flavescens) martiensseni</i>	
<i>C. monax</i> ^{A, on the IUCN list (K)}	
<u><i>C. telfordi</i></u> ^{F,G, Hutterer (1986), on the IUCN list (K)}	
<u><i>Myosorex geata</i></u> ^{F,G, on the IUCN list (K)}	
<u><i>Sylvisorex howelli howelli</i></u> ^{F,G, Jenkins (1984), on the IUCN list (K)}	
<i>Rhynchocyon peters</i> ^{F,G, on the IUCN list (R)}	Black and Rufous Elephant Shrew
<i>Petrodromus tetradactylus tetradactylus</i> (<i>P. rovumae nigriseta</i> ^B)	

CHIROPTERA

<i>Rousettus lanosus kempfi</i>	Mountain Fruit Bat
<i>Nycteris thebaica</i>	
<i>N. hispida</i>	
<i>N. thebaica</i>	
<i>Rhinolophus landeri lobatus</i>	
<i>Hipposideros caffer caffer</i>	
<i>Myotis welwitschii venustus</i>	
<i>Pipistrellus kuhlii fuscatus</i>	
<i>P. nanus nanus</i>	
<i>Scotophilus viridis viridis</i>	
<i>Chalinolobus argentatus</i>	
<i>Kerivoula africana</i> ^{on the IUCN list (EX?)}	(There is some debate on whether this species occurs)
<i>Miniopterus shreibersi arenarius</i>	

PRIMATES

<i>Galago crassicaudatus crassicaudatus</i>	Greater Galago
<u><i>G. zanzibarius</i></u> ^{on the IUCN list (V), C, F, G}	Zanzibar Galago
<i>Cercopithecus mitis kibonotensis</i> ^F	Blue Monkey
<i>Colobus (polycomos) angolensis palliatus</i> ^F	Black and White Colobus

CARNIVORA

<i>Aonyx capensis</i>	African Clawless Otter
<i>Civettictis civetta</i>	African Civet
<i>Genetta tigrina</i>	Blotched Genet
<i>Nandinia binotata</i> ^F	Palm Civet
<i>Herpestes sanguineus</i>	Slender Mongoose
<i>Felis serval</i>	Serval Cat
<i>Panthera pardus</i> ^{on the IUCN list (I), CITES}	Leopard

HYRACOIDEA

<i>Dendrohyrax validus terricola</i> ^{F,G,on the IUCN list (I)}	Tree Hyrax
<i>(Dendrohyrax validus schusteri)</i> ^{D,G}	Tree Hyrax)

ARTIODACTYLA

<i>Potamochoerus porcus</i>	Bush-Pig
<i>Cephalophus harvei harvei</i> ^F	Harvey's Red Duiker
<i>C. monticola schusteri</i> ^{CITES,F}	Blue Duiker
<i>C. spadix</i> ^{IUCN List (V),F,G}	Abbot's Duiker
<i>Neostragus moschatus</i>	Suni
<i>Tragelaphus scriptus</i>	Bushbuck

RODENTIA

<i>Paraxerus ochraceus ochraceus</i>	
<i>P. palliatus</i> ^{F,G}	
<i>Funisciurus (Paraxerus) lucifer byatti</i> ^{F,G}	
<i>Anomalurus derbianus orientalis</i> ^{CITES,F}	Lord Derby's Anomalure
<i>Grammomys surdaster surdaster</i>	
<i>Dasymys incomtus</i>	
<i>Pelomys fallax iridiscens</i>	
<i>Lemniscomys griselda</i>	
<i>Rattus rattus</i>	Black Rat
<i>R. jacksoni jacksoni</i> ^H	
<i>R. taitae</i> ^H	
<i>R. carillus weileri</i> ^H	
<i>R. coucha victoridae</i> ^H	
<i>Mus minutoides</i>	
<i>Lophuromys flavopunctatus</i> ^F	
<i>L. sikapusi</i> ^F	
<i>Cricetomys gambianus</i>	
<i>Dendromus mesomelas</i>	
<i>Otomys denti</i> ^{F,E}	

- ❖ *The checklist is based on Swynnerton and Hayman (1950). Species names have been revised according to Honacki *et al.* (1982), Kingdon (1971, 1974, 1977, 1979 and 1982) and Meester and Setzer (1971). One newly described species (Jenkins 1984) and one new subspecies (Hutterer 1986) of insectivore have been added.
- According to Kingdon (1974), *Crocidura monax* occurs on Mt. Kilimanjaro only. However, it is included because specimens attributable to the species-group within which it occurs are known from the Ulugurus.
 - According to Honacki *et al.* (1982) *Petrodromus rovumae* is now included in *P. tetradactylus* as *P. t. rovumae* subsp.
 - Swynnerton and Hayman (1950) mention two subsp. of galagos: *Galago demidovii orinus* and *Galago senegalensis zanzibaricus* which according to Kingdon (1971) are both synonymous with *Galago zanzibaricus*. According to P. Honess (*in litt.* 1994) the bushbaby previously named as *Galago demidovii orinus* is a dwarf galago but certainly not a *demidovii*. Research into this form and a lowland evergreen forest dwarf bushbaby (found at Kimboza) is ongoing to determine their phylogenetic relationships within the group and to name them correctly.
 - Kingdon (1971) does not recognise *Dendrohyrax validus schusteri* as a separate subspecies but believes that this single individual may be a hybrid between *D. validus* and *Heterohyrax brucei*. This seems odd as *Heterohyrax brucei* is not reported from the Ulugurus.
 - Otomys kempfi* is now included in *O. denti* according to Honacki *et al.* (1982).
 - Forest-dependent (Kingdon and Howell 1993).
 - Restricted to eastern and southwestern Tanzania (Kingdon and Howell 1993).
 - These species are not included in Honacki *et al.* (1982) and are therefore treated under the names used by Swynnerton and Hayman (1950).

Table 7.1. Millipede species known from the Uluguru Mountains.

Unpublished records kindly made available by Dr. H. Enghoff are included. All the listed species, except *Epibolus pulchripes*, must be considered true forest species. They either live in humid decaying wood or on/in the forest floor. Taxonomy follows Hoffman (1979) and Enghoff (1983).

Underlined: Collected during the 1993 survey.
 ** Endemic to the Uluguru Mountains.
 * Endemic to Tanzania.
 a Represented only by juveniles and females. Specific identification of millipedes depends on male gonopods (reproductive organs). In several cases only juveniles and females were found, and these specimens could only be identified to genus or family. Individuals of the families Fuhrmannodesmidae, Paradoxosomatidae and Pyrgodesmidae are quite small and therefore difficult to work with. Probably my specimens from these three families represent taxa new to science.

Class: Diplopoda

Subclass: Chilognatha

Infraclass: Helminthomorpha

Subterclass: Eugnatha

Superorder: Merocheta

Order: Polydesmida (Leach 1814)

Family: Ammodesmidae (Cook 1896)

a

Ammodesmidae sp.

*

Elassystema pongwe (Hoffman and Howell 1981)

Family: Cryptodesmidae (Karsch 1879)

*

Elythemus enghoffi (Hoffman 1978)

Family: Fuhrmannodesmidae (Brolemann 1916)

a

Fuhrmannodesmidae sp.

Family: Gomphodesmidae (Cook 1896)

**

Uluguria inexpectata (Hoffman 1964)

Family: Oxydesmidae (Cook 1895)

**

Alloctoproctus sp. 1 (probably a new species)

**

A. stoltzei (Hoffman 1990)

**

Gonepacra eos (Hoffman 1990)

**

G. lescurei (Demange 1977)

**

Lyodesmus kimboza (Hoffman 1990)

**

L. rubidopsis (Kraus 1958)

**

Morogorodesmus restans (Hoffman 1967)

a

Oxydesmini sp.

**

Rhododesmus planus planus (Kraus 1958)

Family: Paradoxosomatidae (Daday 1889)

a

Paradoxosomatini sp.

**

Suohelisoma ulugurensis (Hoffman 1964)

Family: Pyrgodesmidae (Silvestri 1896)

a

Pyrgodesmidae sp.

Superorder: Nematophora

Order: Stemmiulida (Pocock 1895)

Family: Stemmiulidae (Pocock 1894)

**

Stemmiulus uluguruensis (Mauriès 1989)

**

S. albicephalus (Mauriès 1989)

Superorder: Juliformia

Order: Spirobolida (Bollman 1893)

Family: Pachybolidae (Cook 1897)

**

Epibolus pulchripes (Gerstäcker 1873)

**

Pachybolus morogoroensis (Kraus 1958)

a

Pachybolus sp.

Order: Spirostreptida (Brandt 1833)

Family: Harpagophoridae (Attems 1909)

**

Obelostreptus cf. proximospinosus (Krabbe 1982)

Family: Odontopygidae (Attems 1909)

- ** *Allantogonus* sp. 1
 - ** *Hoffmanides dissutus* (Hoffman 1963)
 - ** *Odontopyge* sp. 1 (probably a new species)
 - ** *Odontopyge* sp. 2 (probably a new species)
 - a *Odontopygidae* sp.
 - * *Plethocrossus tardus* (Attems 1914)
 - a *Xystopyge* sp.
- Family: Spirostreptidae (Brandt 1833)
- ** *Attemsostreptus costatus* (Verhoeff 1941)
 - ** *A. orobius* (Kraus 1958)
 - ** *Lophostreptus poriger* (Verhoeff 1941)
 - * *Spirostreptus hamatus* (Demange 1977)
 - ** *S. inflatannulatus* (Verhoeff 1941)
 - ** *S. nebularis* (Kraus 1958)

Table 7.2. Endemicity of some invertebrate groups occurring in the Ulugurus (current knowledge).

<u>Invertebrate group</u>	<u>Endemicity</u>	<u>Reference</u>
<i>With little ability to disperse</i>		
Millipedes (Diplopoda)	82 % (23 of 28 taxa)	Table 7.1
Harvestmen (Opiliones)	88 % (15 of 17 species)	Lawrence 1963
Montane groundbeetles (Coleoptera: Carabidae)	95 % (41 of 43 species)	Basilewsky (1976)
Pselaphids (Coleoptera: Pselaphidae)	100 % (all 43 species)	Leleup (1965, 1976)
Montane forest earwigs (Dermaptera)	91 % (10 of 11 species)	Brindle (1975)
<i>Able to balloon or good flyers</i>		
Linyphiid dwarf spiders (Araneae: Linyphiidae)	82 % (14 of 17 species)	Scharff (1992, 1993)
Butterflies (Lepidoptera)	27 % (10 of 37 species)	de Jong & Congdon (1993)

Table 7.2. Shows that 23 (82 %) of 28⁵ millipede taxa known from the Uluguru Mountains are endemic. A further four are endemic to Tanzania. The remaining 8 taxa have either not been identified to species or are known also from other mountains.

⁵ Reading Table 7.1 it is clear that at least 36 species occur in the Ulugurus. The reason for including only 28 of them in the calculation of the percentage of endemism is that it is not possible to say whether some of the last eight taxa may actually be endemic as well

Table 8.1. Woody species identified from eight plots (47 of 100 species have been identified) at Kimhandu and Lanzi.

Table 8.1.	Kim-1 1520 m	Kim-2 1710 m	Kim-3 1940 m	Kim-4 2145 m	Kim-5 2520 m	Lanzi-1 1710 m	Lanzi-2 1920 m	Lanzi-3 2110 m
<i>Agaurea salicifolia</i> (Lam.) Hook.				*				
<i>Allanblackia ulugurensis</i> Engl.	*	*	*	*		*		
<i>Alsodeiopsis schumannii</i> (Engl.) Engl.	*							
<i>Aphloia theiformis</i> (Vahl) Benn.			*	*		*	*	*
<i>Berberis holstii</i> Engl.					*			
<i>Canthium oligocarpum</i> Hiern subsp.						*	*	
<i>Cassipourea gummiflua</i> Tul.					*			*
<i>C. malosana</i> (Baker) Alston	*	*	*	*		*	*	*
<i>Chrysophyllum gorungosanum</i> Engl.	*							
<i>Cornus volkensii</i> Harms		*						
<i>Cryptocarya liebertiana</i> Engl.							*	
<i>Dichapetalum eikii</i> Ruhl.	*							
<i>Dracaena afromontana</i> Mildbr.		*	*					
<i>Faurea wenzeliana</i> Engl.				*				
<i>Ficalhoa laurifolia</i> Hiern	*						*	*
<i>Garcinia volkensii</i> Engl.	*	*	*	*		*	*	*
<i>Ilex mitis</i> (L.) Radlk. var. <i>mitis</i>	*	*	*	*		*	*	*
<i>I. mitis</i> (L.) Radlk. var. <i>schliebenii</i> Loes.					*			
<i>Lasianthus cereiflorus</i> E.A. Bruce	*	*	*	*				
<i>Lepidotrichilia volkensii</i> (Gurke) J.-F.				*				
<i>Lijndenia brenanii</i> (A. & R. Fernandes)	*							
<i>Macaranga kilimandscharica</i> Pax						*		*
<i>Maesa lanceolata</i> Forssk.	*	*	*					
<i>Maytenus undata</i> (Thunb.) Blakelock		*	*					
<i>Memecylon myrtilloides</i> Markgr.							*	
<i>Mostea brunonis</i> Didr.						*	*	
<i>Myrianthus holstii</i> Engl.		*						
<i>Ochna holstii</i> Engl.				*			*	
<i>Ocotea usambarensis</i> Engl.				*		*	*	*
<i>Oxyanthus speciosus</i> DC.						*	*	
<i>Parinari excelsa</i> Sabine	*							
<i>Pauridiantha paucinervis</i> (Hiern)	*	*						
<i>P. symplocoides</i> (Moore) Bremek.			*					
<i>Peddiea puberula</i> Domke				*	*			
<i>Piper capense</i> L.f.		*	*					
<i>Pittosporum goetzei</i> Engl.					*			
<i>Podocarpus henkelii</i> Stapf				*	*	*	*	*
<i>Rapanea melanophloeos</i> (L.) Mez	*	*		*	*	*	*	*
<i>Rawsonia reticulata</i> Gilg			*				*	
<i>Rhipidantha chlorantha</i> (K. Schum.)		*						
<i>Rytigynia lichenoxenos</i> (K. Schum.)	*					*		
<i>Schefflera lukwangulensis</i> (Engl.) Engl.	*		*	*			*	*
<i>Symphonia globulifera</i> L.f.	*	*	*	*		*	*	
<i>Syzygium guineense</i> (Willd.) DC. subsp.	*		*	*				
<i>Syzygium parvulum</i> Mildbr.					*		*	
<i>S. sclerophyllum</i> Brenan					*	*		
<i>Zenkerella capparidacea</i> (Taub.) J. Leon.	*	*						

Table 8.1. Eastern Arc endemics are marked with an asterisk in front of the name, Uluguru endemics with two asterisks in front of the name. The plots at Kinhandu-1 (1520 m) and lanzi-1 (1710 m) were not very far from the forest edge and were affected by human disturbance.

Table 8.2. Total number of species and structural data for Kimhandu and Lanzi plots.

Table 8.2.	Total BA (m ² /ha)	No. of stems	No. of individuals	No. of spp.	Canopy base	Height midstorey	Height canopy	Height emergents
Kim-1 1520 m	141.57	91	84	26	5-6 m	10-12 m	20-30 m	40 m
Kim-2 1710 m	39.64	152	145	34	3-4 m	6-8 m	20-30 m	55 m
Kim-3 1940 m	50.21	157	142	28	6-10 m	10-15 m	25-30 m	45 m
Kim-4 2145 m	136.12	146	141	27	6-8 m	10-12 m	20-25 m	35 m
Kim-5 2520 m	37.28	170	136	17	3-5 m	5-7 m	12-15 m	25 m
Lanzi-1 1710 m	99.81	101	98	20	6-8 m	15-20 m	24-28 m	40 m
Lanzi-2 1920 m	89.20	233	222	30	6-8 m	15-20 m	25-30 m	40 m
Lanzi-3 2110 m	82.75	100	93	18	8-10 m	20-25 m	27-30 m	40 m

Table 8.2. Unidentified species are included. At the Kimhandu-5 (2520 m) plot there were dense stands of bamboo. These are not included which should be taken into consideration for interpretation of number of stems and basal area.

Table 8.3. Diversity indices for Kimhandu and Lanzi plots.

Table 8.3.	Kim-1 1520 m	Kim-2 1710 m	Lanzi-1 1710 m	Lanzi-2 1920 m	Kim-3 1940 m	Lanzi-3 2110 m	Kim-4 2145 m	Kim-5 2520 m
Simpson index	4.06	4.82	2.19	11.97	5.86	3.73	4.05	4.16
Equitability	0.15	0.14	0.11	0.40	0.21	0.21	0.15	0.24
Shannon index	1.68	2.19	1.20	2.69	2.12	1.70	1.82	1.71
Equitability	0.51	0.62	0.40	0.79	0.64	0.59	0.55	0.60
No. of spp.	26	34	20	30	28	18	27	17

Table 8.3. Three different diversity measures are used to assess the diversity in the plots:

The Simpson index: $D = \sum ([n_i (n_i - 1)]/[N(N - 1)])$, where n_i = the basal area of the i th species, and N = the total basal area. The reciprocal of the Simpson index is used so that the value of the index increases with increasing diversity. Simpson's index is biased towards showing species evenness, equitability is expressed as the index proportion of total number of species. The Shannon index: $H' = \sum p_i \ln p_i$, where p_i is the proportional basal area (n_i/N) of the i th species. Shannon's index which is biased towards species richness (Magurran 1988) equitability is expressed as the index proportion of \ln to total number of species. The total number of species. This is a simple expression of the numbers of species recorded in each plot.

Figure 8.1: Kimhandu-1 (1510 m). Basal area dominant species.

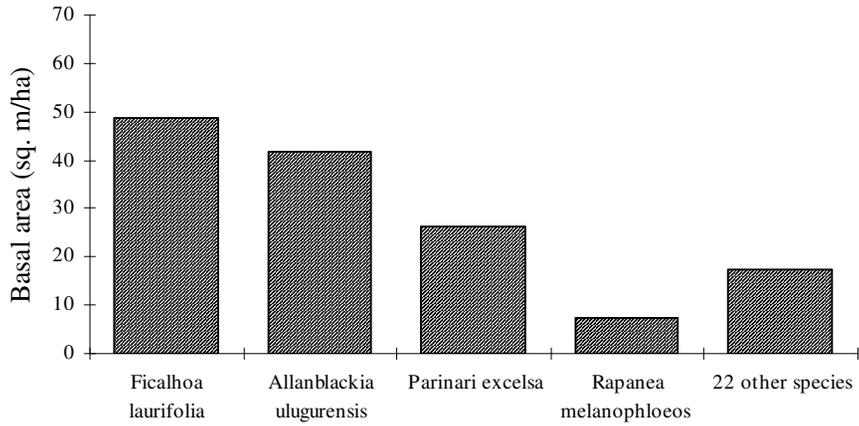


Figure 8.2: Kimhandu-2 (1710 m). Basal area dominant species.

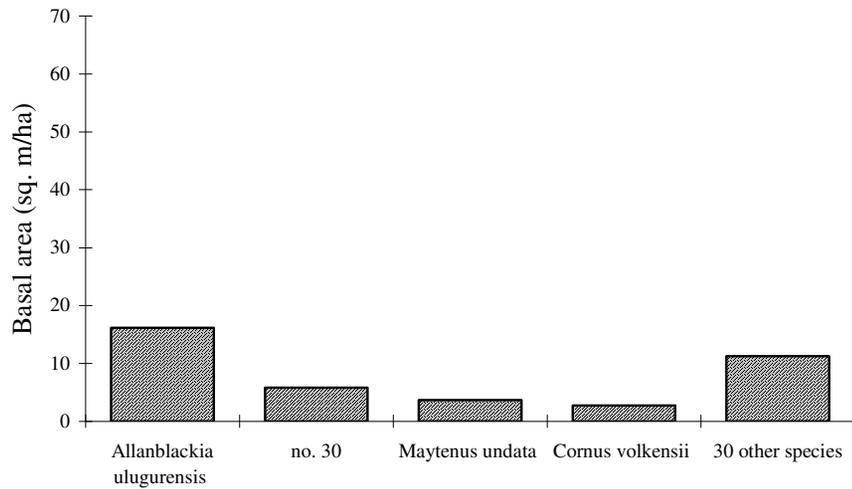


Figure 8.9: Kimhandu-1 (1510 m). Dominant species in terms of number of stems.

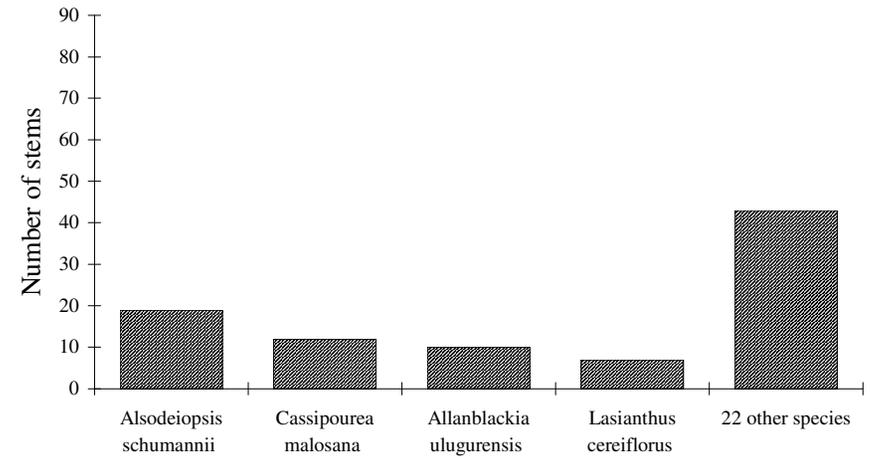


Figure 8.10: Kimhandu-2 (1710 m). Dominant species in terms of number of stems.

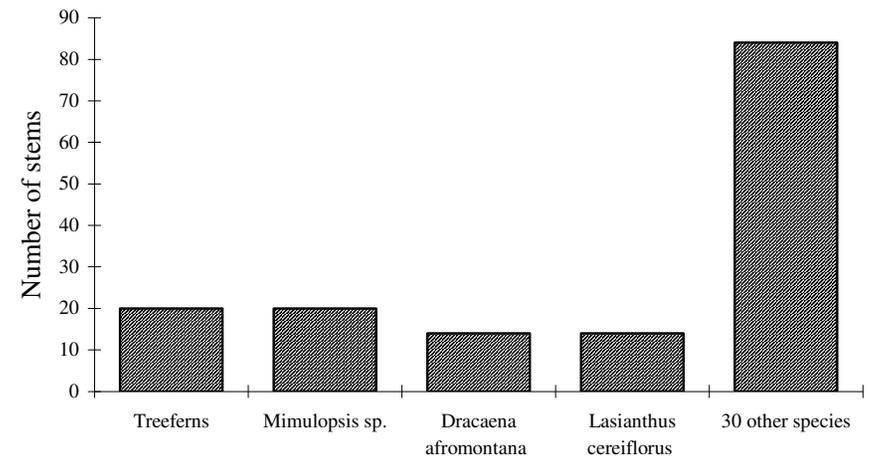


Figure 8.3: Kimhandu-3 (1940 m). Dominant species in terms of basal area.

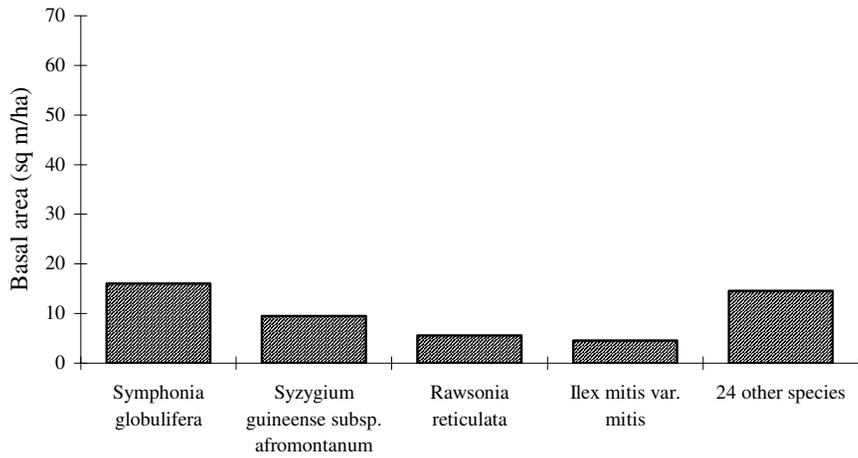


Figure 8.6: Kimhandu-3 (1940 m). Dominant species in terms of number of stems.

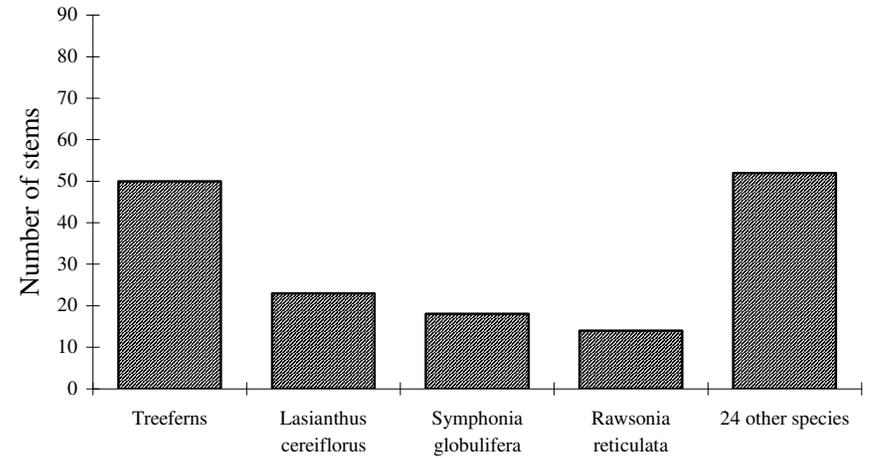


Figure 8.4: Kimhandu-4 (2145 m). Basal area in terms of dominant species.

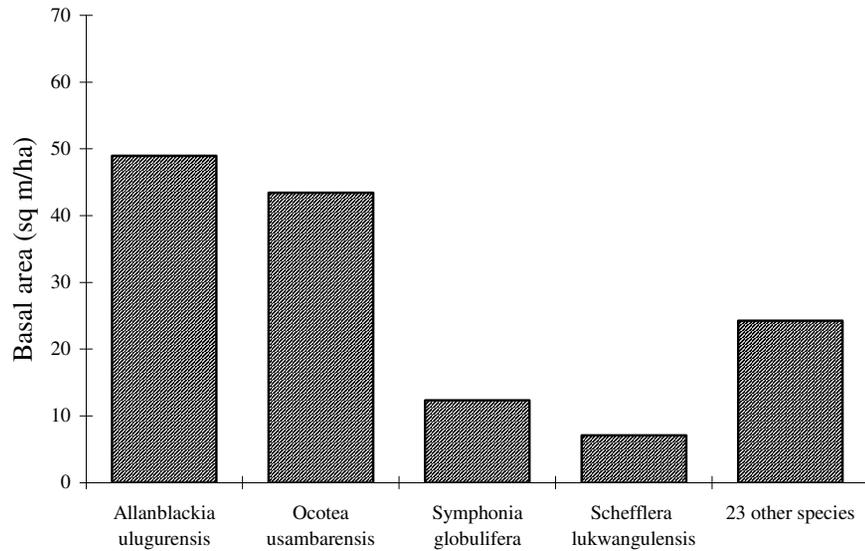


Figure 8.12: Kimhandu-4 (2145 m). Dominant species in terms of number of stems.

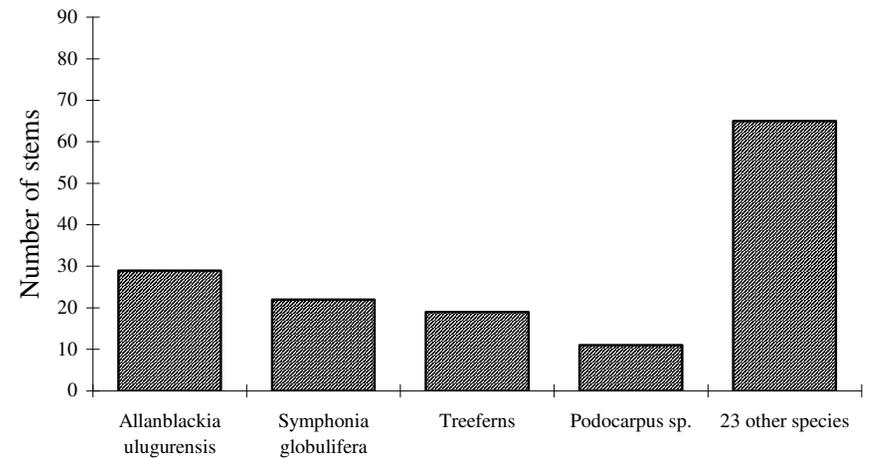


Figure 8.5: Kimhandu-5 (2520 m). Basal area dominant species.

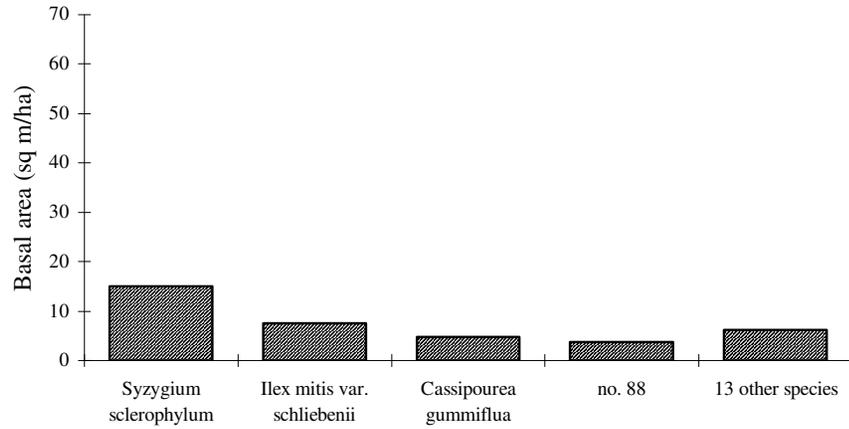


Figure 8.13: Kimhandu-5 (2520 m). Dominant species in terms of number of stems.

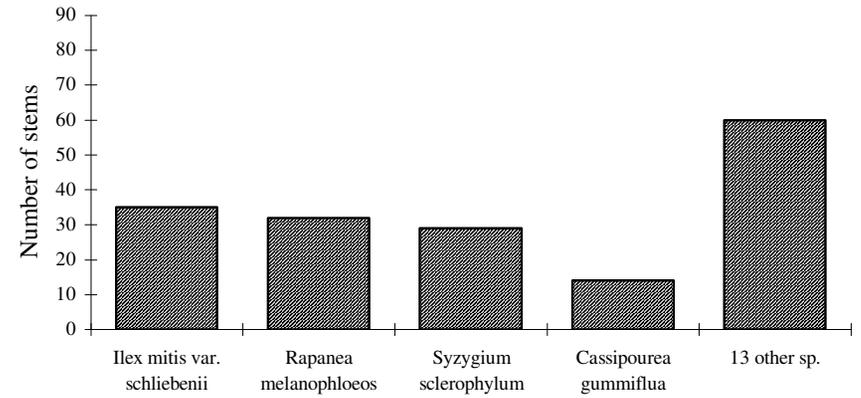


Figure 8.6: Lanzi-1 (1710 m). Basal area dominant species.

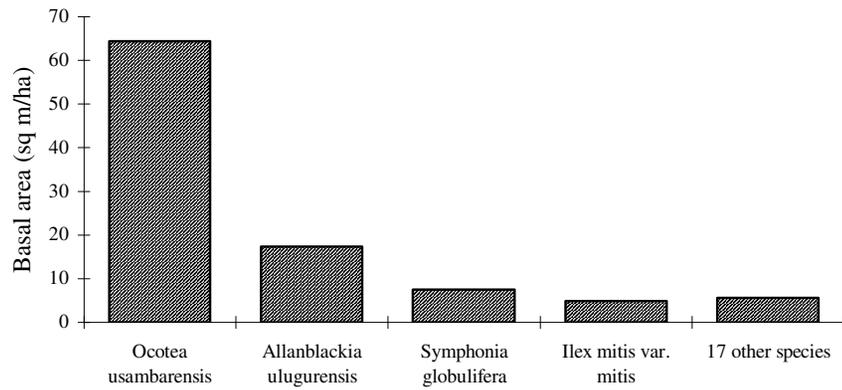


Figure 8.14: Lanzi-1 (1710 m). Dominant species in terms of number of stems.

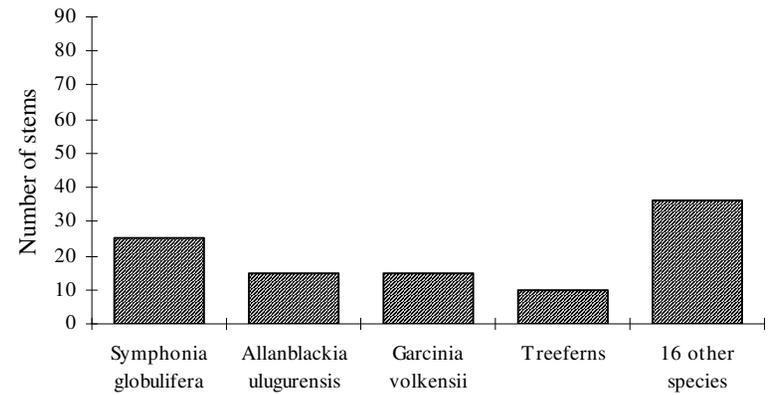


Figure 8.7: Lanzi-2 (1920 m). Basal area dominant species.

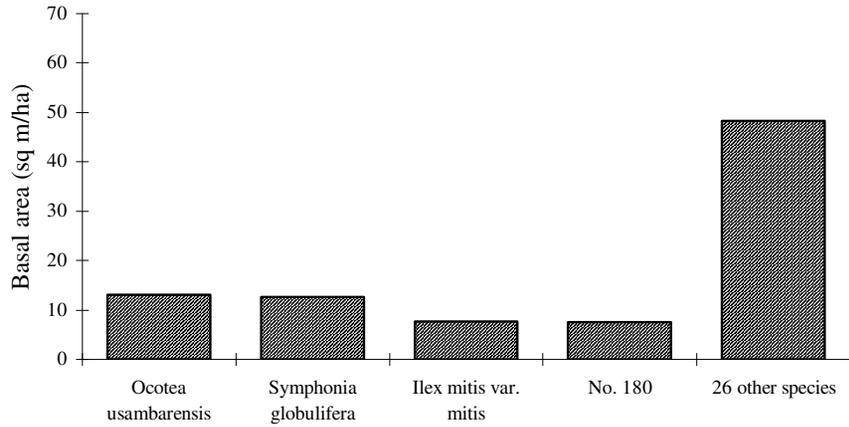


Figure 8.15: Lanzi-2 (1920 m). Dominant species in terms of number of stems.

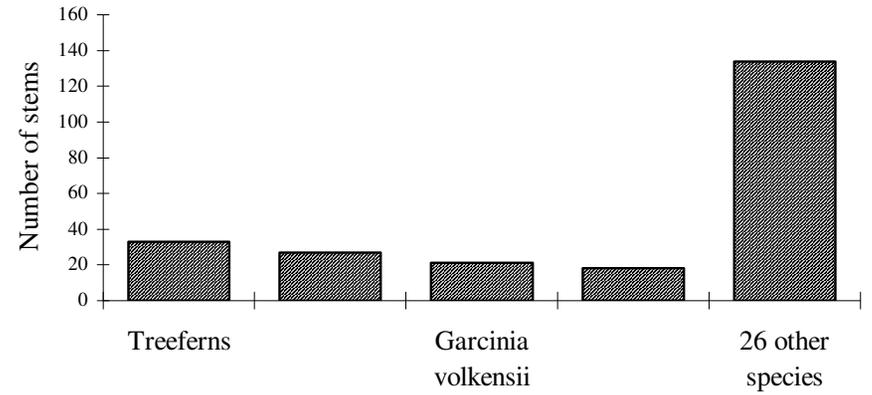


Figure 8.8: Lanzi-3 (2110 m). Basal area dominant species.

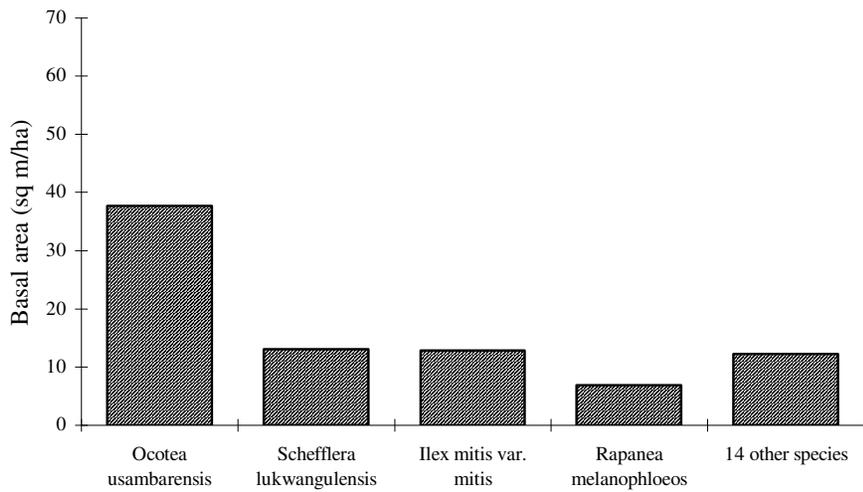
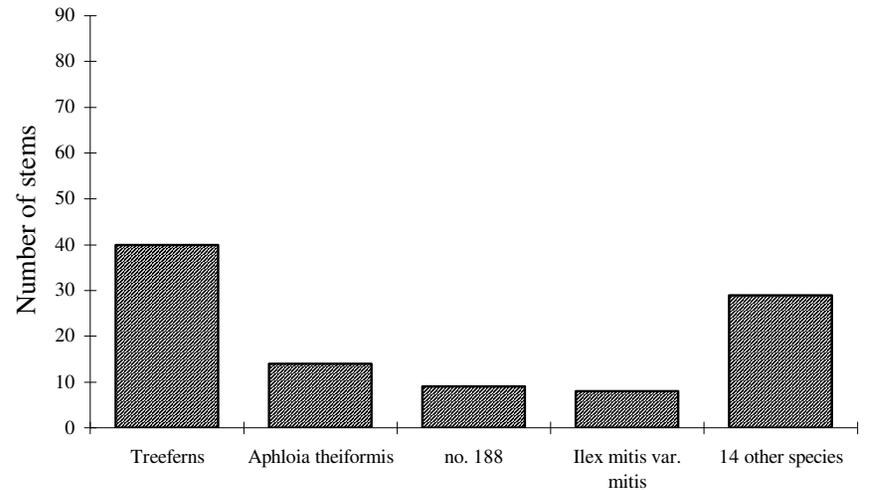


Figure 8.16: Lanzi-3 (2110 m). Dominant species in terms of number of stems.



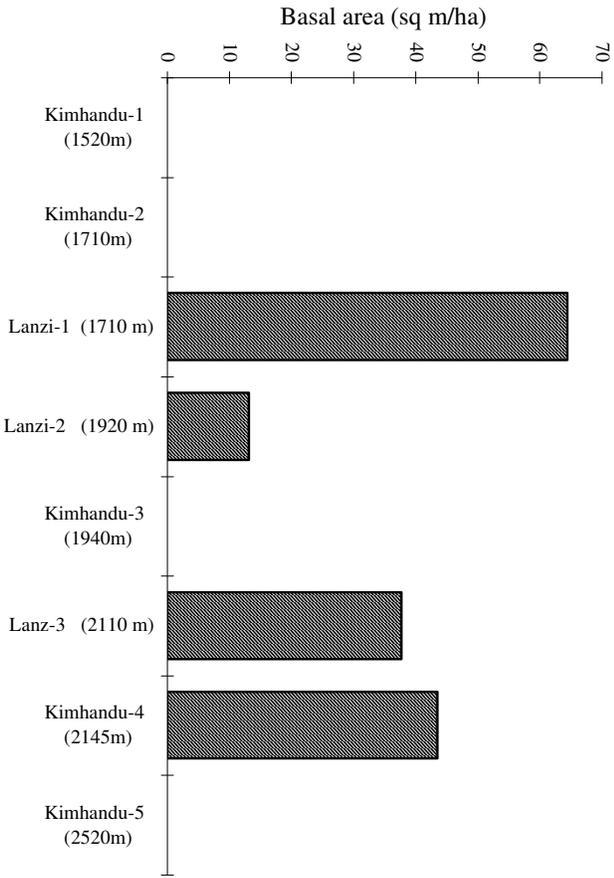


Figure 8.19: Total basal area of *Ocotea usambarensis* Engl.

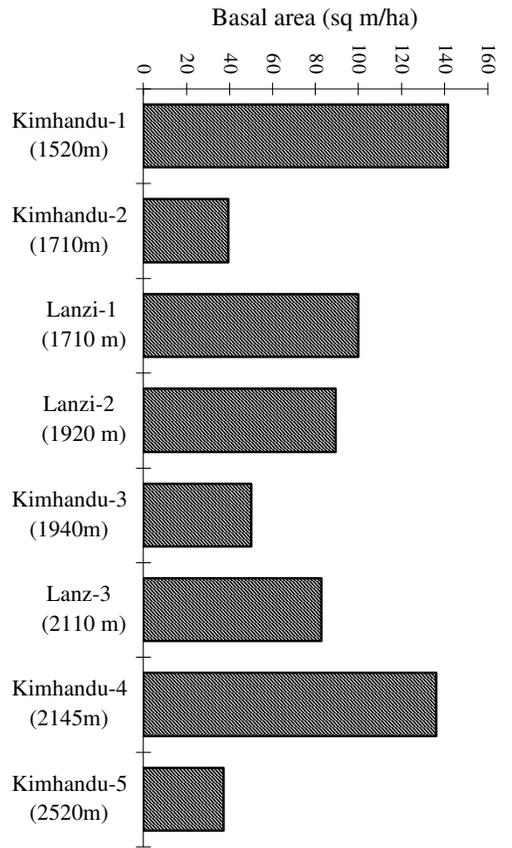


Figure 8.17: Total basal area for the eight plots.

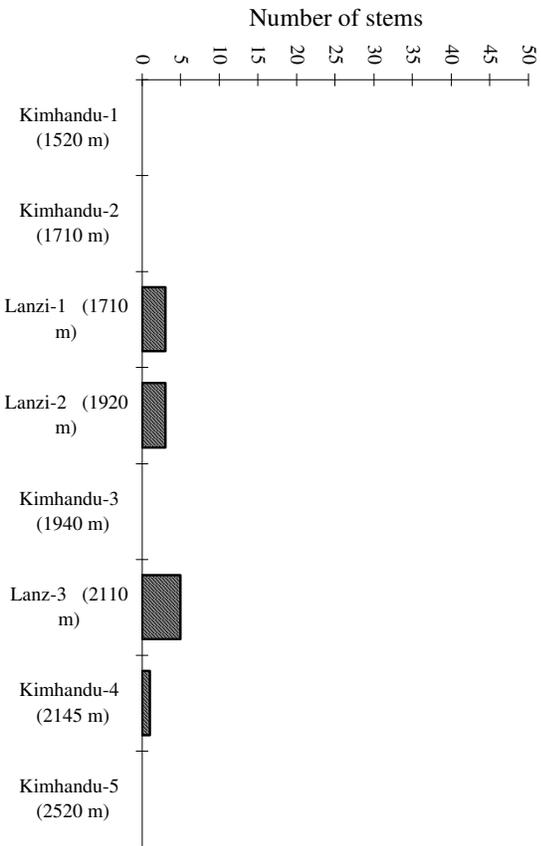


Figure 8.20: *Ocotea usambarensis* Engl., number of stems

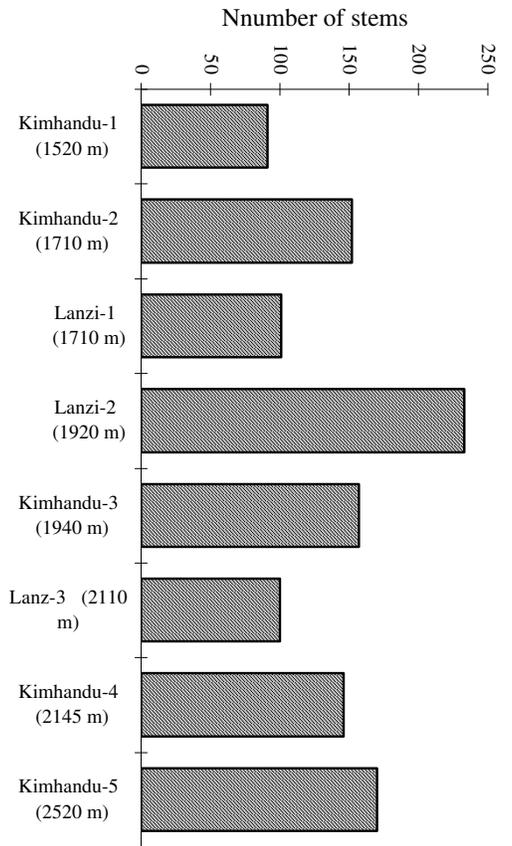


Figure 8.18: Total number of stems for the eight plots.

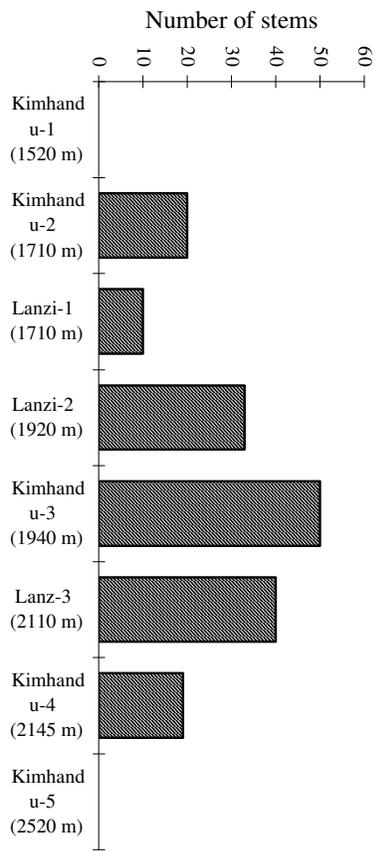


Figure 8.23: Treeferns, number of stems.

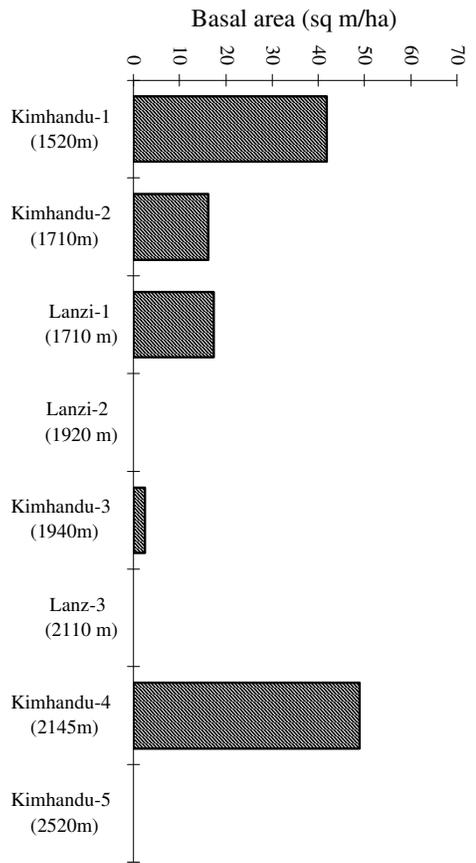


Figure 8.21: Total basal area of *Allanblackia ulugurensis* Engl.

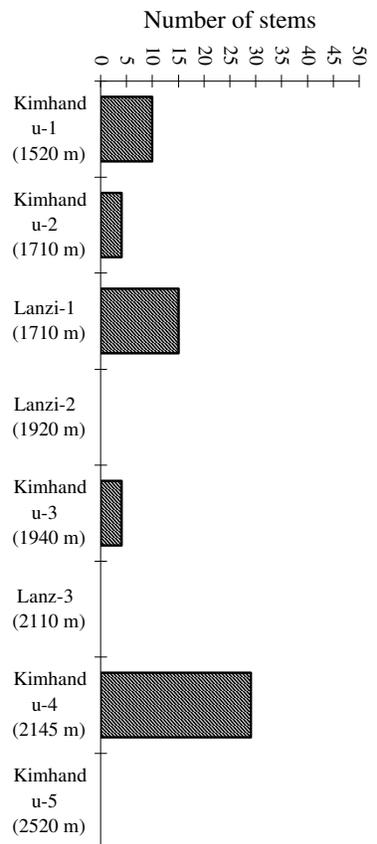


Figure 8.22: *Allanblackia ulugurensis* Engl., number of stems.

APPENDIX 2 (BACKGROUND OF THE SURVEY AND ITINERARY).

Appendix 2.1. Background of the survey and the contents of this report.

Time schedule of planning. **The two team leaders started their planning 1 May 1993, four and a half months before departure. Initial preparations comprised identification of a field crew, formulation of a fieldwork programme, contacts to relevant collaborating parties, purchasing equipment and - not the least - seeking economic support for the project. The planning phase was hectic and difficult, due to little time available and other duties, lack of good maps until late in the summer and much uncertainty as to whether it was possible to gain access to the Uluguru North F.R. (access had been prohibited for foreigners for some years). Furthermore the initial purpose of the trip was changed during the planning phase following discussions with RSPB and access to new information.**

Birds (Section 5). Before our survey the Uluguru South F.R. (by far the largest in the Ulugurus) was very little known biologically. For birds the only visit to the eastern slopes were some collecting activities of Loveridge at Nyingwa and Nyange in the 1920ies (see Appendix 5.1 and Figure 1.3). Some visits had also been paid to the Tchenzema and Bunduki areas on the western slopes. Stuart and Jensen (1985) recommended that new ornithological surveys should focus on the southeastern section of the Uluguru. The initial purpose of the trip from ZMUC was to combine (1) a study of the unknown eastern slopes of the Uluguru South F.R. with (2) training of "new" Danish students and ornithologists in fieldwork techniques (to involve them in fieldwork in the tropics, especially in Tanzania) and (3) further testing of methods to be used for quantifying the avifauna of the Eastern Arc (for a large-scale study with the aim of explaining biogeographical patterns and pointing out conservation priorities).

However, following discussions during the summer with RSPB (running the Uluguru Slopes Planning Project) who had funds for a standardised survey of the two endemic bird species but also was interested in a standardised description of the avifauna, a compromise was reached between ZMUC and RSPB. The plans of testing various methods was skipped. A contract was signed with RSPB early September, including the following obligations:

- As far as is practicable, to survey population status or distribution within the Uluguru Mountains of the two endemic bird species (Loveridge's Sunbird and Uluguru Bush Shrike). (This should be done primarily using standardised and repeatable methods).
- As far as is practicable, to determine the bird assemblage of the mountain forests using standardised and repeatable methods, and to determine the conservation significance of these forests.
-
- To ensure the participation of Tanzanian scientists/foresters in the survey work.
-
- To work towards the production of an overall assessment of the biodiversity conservation significance of the Uluguru Mountain forests.
-
- To give recommendations for any further work considered necessary to build on the achievements of the project.

Standardised methods were applied to describe the avifauna along three gradients - two on the very unknown eastern slopes of the Uluguru South F.R. and - for comparison - one in the better known Uluguru North F.R. Additional localities were visited by JF, who brought a car, for improving the overview (Tchenzema, Kimboza, Bunduki, Morningside and - in the autumn 1994 Kigurunyembe). This has provided a solid description of the general avifauna, including the density of the endemic Near-threatened species *Nectarinia loveridgei*. As much time as possible was used to search for rare species ("general birdwatching") and to survey the entire gradient. However, in a rugged and difficult terrain with a tight time schedule we often felt that time was limited for locating the most scarce birds (with "general birdwatching") like some of the threatened species. These species are not detected by standardised methods but rather by extensive surveying. Three of the Threatened species were located, including the endemic *Malaconotus alius*, and in combination with earlier data, literature studies and own experience from earlier fieldwork in the Eastern Arc we have been able to preliminarily assess the geographical distribution of Threatened species in the Uluguru.

The reason for choosing the altitudes 1345 m, 1520 m, 1720 m, 1920 m and 2145 m for camp sites is that standardized mistnetting were carried out in the same altitudes in the Udzungwas 1991-92 by LAH and JOS. Potential campsites had first

been found on the 1:50.000 maps. Using the same altitudes in the Ulugurus during the present survey, a basis has been provided for a later comparison between the Uluguru and the Udzungwa Mountains.

A review of earlier ornithological survey work and an assessment of the value of Kimboza Forest for altitudinal migrants from the montane forests has been included to facilitate an overall assessment of the Ulugurus and to facilitate planning of coming surveys. A number of ecological details on birds which are not of direct importance for conservation matters have been included in order to leave a relatively complete published description of our findings. In Appendix 5.3 we comment on the completeness of the ornithological survey and also on our experience with the methods used. Though this report may not be the right forum for the latter we decided to include it since there is much interest among ornithologists for developing a standard manual for surveys of tropical forests. For the planning of such a manual (and for planners of new surveys in the Eastern Arc and elsewhere) we believe that it is useful if notes are left in an easily accessible way from all surveys on experiences and ideas of methods and ways of presenting data.

The contract with RSPB included fieldwork only on birds. However, there was much interest from the Botanical and Zoological Museum of Copenhagen in forming a multi-disciplinary team (to obtain data for the Eastern Arc Biodiversity Programme and to train and involve students and Tanzanian foresters) so the participation of botanists was ensured from the earliest phase of the planning and later people working with millipeds and mammals agreed to participate.

Botany (Section 8). A larger database exists of botanical plots from many Tanzanian forests. These data are of species composition and vegetation structure. However, many areas in the Ulugurus had not been studied before, including the eastern slopes of the Uluguru South F.R. There was therefore much interest in obtaining data from these areas. At each of the 12 mistnetting stations in the Uluguru mountain forests (Kimhandu, Lanzi and Tegetero areas) a 25x25 m plot was assessed for woody species with a stem diameter (dbh) of more than 3 cm. All plots were placed adjacent to the mistnetting sites. A further three plots were assessed in the lowland Kimboza Forest during the survey. To obtain knowledge on the use of plants by local villagers, ethnobotanical data were collected.

It was not possible to identify all plant specimens collected at Kimhandu and Lanzi within the time available for producing the botany chapter because of other duties and since some of the specimens have to be compared with material from other herbariums. Preliminary data are listed in this report to give some idea about the vegetation at the study sites and the character of the data. Full species lists and further structural data will be published in papers planned by JCL and PH. The results of the botanical plots at Tegetero and results of the ethnobotanical research are published in a separate report (Mabula et al. 1994). The results of three plots assessed in Kimboza Forest by JCL in November will be published later. An updated assessment of the biodiversity value of the Uluguru forests in terms of plants is presented in Section 8. It was, however, not possible to go into an assessment of percentages of endemism within the time available for producing the botany chapter.

Mammals and millipeds (Sections 6 and 7). Initially the field team comprised only ornithologists and botanists. In August 1993 we succeeded in making a final arrangement with LLS and JNK who were planning to do fieldwork in the Udzungwas in September 1993 that they should spend three of their weeks in Tanzania in the Ulugurus in October, collecting information on millipeds and mammals. The collection of field data were mostly for their own thesis subjects (millipede and Tree Hyrax ecology and taxonomy) but they agreed on producing an account for this report on millipeds and mammals. For mammals field data are presented of hunting pressure (interviews and own observations) together with a list of field observations of mammals made during this survey. An up-dated species list for the Ulugurus and an assessment of the biodiversity value is also presented. For millipeds an updated species list is presented for the Ulugurus, supplemented with an updated assessment of biodiversity value of the Ulugurus for selected invertebrate groups.

Tanzanian participation. Following discussions at University of Dar es Salaam in July 1993 with participation of Drs. Jon Fjeldså (Zoological Museum of Copenhagen), Ib Friis and Jon Lovett (Botanical Museum of Copenhagen) and representatives from University of Dar es Salaam, Tanzania Forestry Research Institute, Institute of Resource Assessment and the Tanzania Commission for Science and Technology it was decided that on this survey foresters from the Tanzania Forestry Research Institute (TAFORI) should participate to learn more about standardised botanical fieldwork and biodiversity projects. Later we ensured the participation of SIM from the Regional Forest Office in Morogoro and of JK from Wildlife Conservation Society of Tanzania (WCST). In October 1993 the foresters agreed to collect information on local villagers' use of woody forest plants.

Conservation of biodiversity (Section 9). No up-to-date assessment of the biodiversity value of the Ulugurus existed. Brief overviews of endemism in certain groups for which information was relatively easily accessible was therefore included. Due to lack of time (and information) it has, however, not been possible to standardise the presentation between groups and to go into a strict comparison with other mountains (except for bird species of special conservation importance).

Conservation of other values in the Ulugurus and the problems the forests and the surrounding human population face (Section 9). A short and easy-read account has been included (Section 9) on problems for the conservation of the Uluguru forests in order to put the information on biodiversity into a wider perspective. We hope that this information, based on the literature and observations from our survey, will be of help to those who wish to get a quick overview of problems in the

mountains. Visiting such an area for the first time it is useful with an entry to the literature. The last part of Section 9 lists proposals for conservation actions, based on the findings of our own fieldwork and information from the literature.

Appendix 3 (Background information on the Uluguru forests)

Appendix 3.1. Description of reserves of mountain forest visited on this survey.

Uluguru North Catchment Forest Reserve. The reserve covers the steep summit ridge and eastern slopes of the northern half of the Uluguru Mountains between Morogoro town and the Mgeta-Bunduki depression, within an altitudinal range of 1000 to 2340 m (Figures 1.2, 1.3 and 1.5). Established: No information. Area: 83.56 km². Gazetted boundary length: 68 km. Summits: From northeast to southwest the main summits are: Lupanga (2138 m), Kinazi (2150 m), Bondwa (2120 m), Nziwane (2270 m), Magari (2340 m), Miwa (1900 m), Mnyanza (2140 m) and Kifuru (2010 m). Soils: Acidic lithosols and ferralitic red, yellow and brown latosols have developed over Precambrian granulite, gneiss and migmatite rocks. Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall stations: Kinole Primary School, Morningside Farm, Tegetero Mission. Estimated rainfall: 1200-3100 mm/year on the western slopes, 2900-4000 mm/year on the eastern slopes. Dry season: Not marked according to Lovett and Pocs (1993). However, in recent years, e.g. in 1993, there was a pronounced dry season (this survey). Temperatures: 22°C max. (December), 17°C min. (July) at lower altitudes.

Temperatures measured during our 1993 survey (all values are mean temperatures for two days and are measured inside forest):

	<u>Night min. (°C)</u>	<u>Day max. (°C)</u>
Tegetero- 1 (1345m):	15.5	22.0
Tegetero-2 (1535m):	14.8	19.5
Tegetero-3 (1710m):	13.5	17.0

Vegetation: With the exception of rock outcrops, the reserve is entirely covered in moist forest. Submontane forest (canopy 30-50 m tall) occurs on the eastern slopes between 1000 and 1500 m above sea level (remarks from this survey: locally even lower in narrow strips), with the best stands above Kinole and Tegetero villages (Lovett and Pocs 1993). On the western slopes this forest type is restricted to valley bottoms near to the lower edge of the forest reserve. Montane forest (15-30 m tall trees) occurs between 1500 and 1900 m. Upper montane forest (canopy 15-20 m tall) occurs above 1900 m on wetter slopes and ridges in the cloud belt, with stunted elfin forest on the highest ridges. Landslips occur. Submontane forest: Canopy 30-50 m tall with: *Albizia gummifera*, *Allanblackia stuhlmannii*, *Aningeria adolfi-friedericii*, *Anthocleista grandiflora*, *Cephalosphaera usambarensis*, *Cylicomorpha parviflora*, *Funtumia africana*, *Myrianthus holstii*, *Sapium ellipticum*, *Syzygium guineense* subsp. *afromontanum*. Trees and shrubs include: *Chlamydomystachya spectabilis*, *Lagynias pallidiflora*, *Micrococca holstii*, *Psychotria* spp. and *Pavetta* spp., *Pseuderanthemum campylosiphon*, *Memecylon cognauxii* and *M. myrtilloides*, *Mesogyne insignis*, *Micrococca holstii*, *Oxyanthus speciosus*, *Peddiea fischeri* and *P. subcordata*. *Commelinaceae* subshrubs include: *Palisota orientalis*, *Polliia condensata* and *P. bracteata*. Herbs include: the Zingiberaceae, *Afromomum* spp. and *Renealmia engleri* with broad leaved grasses such as *Leptaspis cocleata*. On shady cliffs the large *Antrophium mannianum* fern is typical, and a common canopy epiphyte is the giant nest fern, *Asplenium nidus*. In drier areas on the lower edge of the forest, usually below 1000 m, a semi-evergreen submontane forest type also occurs, dominated by *Albizia gummifera* and *Milicia excelsa*. Montane forest: The canopy is much less complex than in the previous type and usually consists of a single layer of 15-30 m tall trees. The dominant species are: *Bridelia brideliifolia*, *Cornus volkensii*, *Cussonia spicata*, *Ficalhoa laurifolia*, *Ocotea usambarensis*, *Podocarpus latifolius*, *Syzygium guineense* subsp. *afromontanum* and *Zenkerella capparidacea*. Shrubs include: *Chassalia parviflora*, *C. violacea*, *Lasiodiscus usambarensis*, *Galineria coffeoides*, *Erythrococca usambarica*, *Euphorbia usambarica*, *Memecylon myrtilloides*, *Mostuea brunonis*, *Psychotria* spp. and *Pavetta* spp., and along streamlets large stands of the treefern *Cyathea manniana* occur. There are many epiphytic ferns and even in the ground layer ferns are the dominants, for example: *Asplenium hypomelas*, *Blotiella stipitata*, *Ctenitis lanuginosa*, *Diplazium pseudoporrectwn*. On drier slopes and ridges a drier type of montane forests occurs with *Olea mildbraedii* and *Cussonia lukwangulensis* in the canopy, and *Blechnum ivohibense* and *P. punctulatum* and *Gleichenia* species in the herb layer. Upper montane forest: Canopy 15-20 m tall with: *Allanblackia ulugurensis*, *Balthasaria schliebenii*, *Podocarpus latifolius*, *P. ensiculus*, *Rapanea melanophloeos*, *Rauwolfia volkensii*, *Schefflera myriantha* and *S. barteri*. Epiphytes include the endemic orchids *Stolzia* spp. The trees and forest floor are thickly covered by bryophytes, which contribute to the catchment value. Shrubs include: *Lasianthus* spp. of which 8 are endemic, and the tree ferns, *Cyathea manniana*, the subendemic *C.*

pumila and the endemic *C. fadenii* and *C. schliebenii*. On the mossy ground several endemic *Impatiens* spp. (like *I. uluguruensis*), *Cinnobotrys oreophila*, endemic *Linnaeopsis* spp. and *Streptocarpus* spp. (like *S. bullatus*) are typical. Elfin forests cover the highest summits and sharp ridges above 2100 m (but at windy, misty habitat sometimes down to about 1800 m altitude), where the shallow soil is completely leached and peaty. The canopy is 2-6 m tall with: *Agauria salicifolia*, *Allanblackia uluguruensis*, *Balthasaria schliebenii*, *Cussonia lukwangulensis*, *Garcinia volkensii*, *Podocarpus ensiculus*, *P. latifolius*, *Syzygium cordatum*, *Ternstroemia polypetala*, *Polyscias stuhlmannii* and *Lobelia lukwangulensis*. The trees form a tight, dense canopy, with masses of bryophytes and tiny, endemic orchids, like *Tridactyle brevifolia*. Dwarf shrubs, like the monotypic endemic *Dionychastrum schliebenii* (on Magari peak), the endemic *Stapfiella ulugurica* and *Streptocarpus hirsutissimus* (on Lupanga Peak), also occur in this habitat. Bamboo (*Sinarundinaria alpina*) thickets occur in the elfin forest on the sharp north ridge of Magari Peak. **Catchment values:** The catchment value is very high as the area has one of the highest rainfalls in Tanzania without a marked dry season. On the eastern side the reserve is part of the Ruvu river catchment, and supplies Dar es Salaam with water. On the western side it supplies Morogoro town and villages on the mountain slopes. **Biodiversity value:** The forests are of the Eastern Arc type and so are rich in species of restricted distribution. More than 40 endemic species of woody plants are known from the Uluguru Mountains. The genera of *Impatiens*, *Lasianthus*, *Linnaeopsis* and *Stolzia* contain many endemics and monotypic endemics and near endemics are *Chlamydstachya spectabilis*, *Dionychastrum schliebenii*, *Sooia macrantha* and *Urogenias ulugurica*. The Uluguru Mountains have three endemic or subendemic giant *Lobelia* species: *L. morogoroensis* in submontane forest, *L. longisepala* in montane forest and *L. lukwangulensis* in upper montane forest. There are many subendemic species which also occur in the Usambara or Nguru Mountains. **Timber values:** *Cephalosphaera usambarensis*, *Ocotea usambarensis*, *Newtonia buchananii*, and *Podocarpus* sp. occur. **Human impacts:** The area adjacent to the reserve is intensively cultivated. Although the forest boundaries are well marked and seemingly intact, many encroachments have occurred and illegal logging has taken place. Pole collecting for building purposes has resulted in most regeneration being removed from areas near the edge of the reserve. Heavy rains have caused serious landslides several times in the area. Fires lit at the end of the dry season cause serious damage every year in the forest reserve. The steep slopes result in the fires spreading rapidly in dry bush and grasslands neighbouring the forest. The area most affected are the slopes of Bigwa and Kibwe Juu, and Lupanga above Morogoro town. **Management proposals (Lovett and Pocs 1993):** The number of forest guards should be increased and proper patrolling of the forest is essential. To meet the local need for building poles and firewood, agroforestry should be encouraged and plantations established on the slopes. This should also increase catchment capacity and control erosion. Proposed zones: Catchment zone: On steeper slopes and ridges. Biodiversity zone: To cover the forest and ridges. **Literature:** Jackson (1970) (reference list of Section 3), Pocs (1974, 1976a and b, 1980), Polhill (1968) (see reference list of Sections 8 and 9).

Uluguru South Catchment Forest Reserve. The reserve covers the southern half of the Uluguru mountains from about 1200 m upwards on the east (remark, editors of this report: generally above 1500 m) and from 1800 m on the western slopes to the summits of Makumbaku (2420 m), Kimhandu (2634 m) and Lukwangule Peak (2638 m). The 20 km² Lukwangule Plateau lies between two parallel north-south ridges at an altitude of over 2300 m. **Area:** 164.3 km². **Established:** No information. **Gazetted boundary length:** 110 km. **Summits:** Kimhandu Hill (highest point 2634 m, a hill area), Makumbaku (2420 m) and the undulating Lukwangule Plateau (20 km², highest point 2638 m). **Soils:** A wide range of acidic lithosols and ferralitic red, yellow and brown iatosols have developed on Precambrian granulite, gneiss and migmatite rocks. A large area of the Lukwangule Plateau is covered by peat deposits. **Climate:** Oceanic rainfall with oceanic temperature. **Nearest rainfall stations:** Bunduki Kibungo Mission, Tchenzema Mission (Lovett and Pocs 1993). On this survey we observed that there are also rainfall stations in Kibungo-Juu (very close to Lanzi village, at 900 m) and at Singiza Mission (at 400 m). **Estimated rainfall:** 2500-4000 mm/year on the eastern slopes and summit to 2000 mm on the western slopes. **Dry season:** On the eastern slopes there is no marked dry season, on the western slopes there is a dry season of from June to October (Lovett and Pocs 1993). However, over the last years the rainfall pattern has changed, and there is now a more pronounced dry season (this survey).

Temperatures measured during our 1993 survey (all values are mean temperatures for two days and are measured inside forest):

	Night min. (°C)	Day max. (°C)
Kimhandu- 1 (1520m):	11.0	19.0
Kimhandu-2 (1710m):	12.0	16.5
Kimhandu-3(1940m):	10.5	14.8
Kimhandu-4(2145m):	8.5	13.8
Kimhandu-5 (2520 m):	3.3	17.0
Lanzi- 1 (1710m):	10.4	18.0
Lanzi-2(1920m):	11.0	18.0
Lanzi-3(2110m):	—	—

On the Lukwangule Plateau and in the Kimhandu Hill area (especially on the meadows there) the temperature can drop to below freezing point at night. During our survey we experienced frosts at the meadow on one of the nights at the Kimhandu-5 (2520 m) station. The temperatures listed for that station above were measured inside the forest where the temperature never reached the freezing point. Vegetation: The eastern and western slopes are covered by moist forest, which surrounds the upland grassland, swamps and forest patches of the Lukwangule Plateau. Montane forest occurs from 1500 to 2400 m, and upper montane forest above 2000 m. Bamboo thickets cover large areas in the upper Mgeta valley and on Kimhandu summit, usually above 2000 m, but also as low as 1600 m in the Mgeta River Valley above Hululu Falls. Landslips occur. Montane forest: No data, but presumably similar to Uluguru North montane forest. Upper montane forest: Canopy 10-15 m tall. Trees on the eastern side include: *Bersama abyssinica*, *Cassipourea malosana*, *Cornus volkensii*, *Cussonia lukwangulensis*, *C. spicata*, *Dombeya torrida*, *Dracaena afromontana*, *Garcinia volkensii*, *Halleria lucida*, *Podocarpus latifolius*, *Rapanea melanophloeos*, *Maesa lanceolata*, *Mystroxydon aethiopicum*, *Nuxia congesta*, *Ocotea usambarensis*, *Polyscias stuhlmannii* and *Xymalos monospora*. Bamboo thickets form dense stands of *Sinarundinaria alpina* 12-15 m tall and 15 cm diameter, with the commonest species in the ground flora being *Selaginella kraussiana*. Grasslands and tree clumps: Grasslands on the Lukwangule plateau consisting of *Panicum lukwangulense* and *Andropogon thystinnus* with scattered trees of *Agauria salicifolia*, *Adenocarpus mannii*, *Myrica salicifolia* and *Herberts* sp. are thought to have replaced upper montane forest following fire. Forest patches contain the trees: *Apodytes dimidiata*, *Cussonia lukwangulensis*, *Ochna oxxyphylla*, *Olea capensis*, *Pittosporum goetzei*, *Syzygium cordatum*, *S. parvulum*; and the giant herb *Lobelia lukwangulensis*. At the Ruvu river springs, peat bogs formed by *Sphagnum* spp., *Eriocaulon schimperii* and *Pycreus nigricans* occur. In boggy places afroalpine species, such as *Ranunculus oreophytus* and *Alchemilla johnstonii* occur. Catchment values: The catchment value of the reserve is extremely high. It covers one of the highest rainfall areas in Tanzania, feeding the Ruvu river which supplies Dar es Salaam. The locally important Mgeta river, also originates in the reserve. Biodiversity value: The forests are of the Eastern Arc type and so are rich in species of restricted distribution. The Uluguru mountain forests contain more than 40 endemic woody species, and they are particularly rich in endemic species of the genera *Impatiens*, *Lasianthus*, *Linnaeopsis* and *Stolzia*. Monotypic endemics are *Dionychastrum schliebenii* and *Sooia macrantha*. *Moraea callista* occurs on the Lukwangule Plateau. The wetter eastern part of the reserve is not known botanically and is likely to contain many species of restricted distribution. Timber value: East African Camphor *Ocotea usambarensis* and Podo *Podocarpus* sp. occur, but no valuable timber trees occur in exploitable amounts. There are large stands of the African mountain bamboo *Sinarundinaria alpina*. (Remarks from the editors of this report: The fieldwork in the Kimhandu and Lanzi area during the 1993 survey showed that there are many Camphors in these areas). Human impact: The reserve is surrounded by cultivation. The Mgeta valley is an important agriculture area producing vegetables which supply Morogoro and Dar es Salaam, the slopes above Tchenzema are cultivated up to 2000 m altitude. Building poles are intensively collected in areas adjacent to cultivation. Encroachment is common and logging was carried out. Heavy rainfall on steep deforested slopes has resulted in serious landslips. Management proposals (Lovett and Pocs 1993): On the western side the boundary is well marked by *Cupressus* and *Eucalyptus*. Planting and clearing of the boundary is continuing. Proper patrolling of the forest is essential. To meet local needs for building poles and firewood, agroforestry should be encouraged and woodlots established on the slopes. This should also increase catchment capacity and control erosion. Successful agroforestry is currently practised near Bunduki and Tchenzema villages. Proposed zones: Catchment zone: To cover the steeper slopes and Lukwangule Plateau. Biodiversity zone: To cover

the forest. Literature: Jackson (1970) (reference list of Section 3), Pocs (1974, 1976a and b, 1980), Polhill (1980), Temple and Rapp (1973) (reference lists of Sections 8 and 9).

Bunduki I and III Catchment Forest Reserves. Eight km from Mgeta. Bunduki I is marked on the topographical map as Vinile F.R. It covers the slope and valley of the Mgeta river from 1220 to 1540 m. Bunduki III is a small reserve on level ground by the Mgeta River just downstream of Bunduki I at 1220 m. Area: Bunduki I: 1.02 km². Bunduki III: 0.03 km². Established: ?. Gazetted boundary length: Bunduki I: 4.9 km. Bunduki III: 0.7 km. Soils: Brown sandy loams over crystalline gneiss. Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Bunduki. Estimated rainfall: 2000 mm/year. Dry season: June-July. Temperatures: 22°C max (December) to 17°C min. (July). Vegetation: Bunduki I is mostly plantation of a variety of species including: *Finns* spp., *Eucalyptus* spp., Bamboo, *Cupressus* spp., *Grevilea robusta* and Avocado. In the undergrowth beneath the plantation, and occasionally within the plantation itself, montane forest trees and shrubs occur. Bunduki III is a small patch of montane or submontane forest (tree height up to 20 m) on a swampy area by the river. Montane forest: Trees to 20 m, including: *Alangium chinense*, *Albizia gummifera*, *Anthocleista grandiflora*, *Bersama abyssinica*, *Cussonia spicata*, *Cylicomorpha parviflora*, *Dracaena steudneri*, *Ficus sur*, *Harungana Madagascariensis*, *Parinari excelsa*, *Polyscias fulva*, *Rauvolfia caffra*, *Syzygium guineense* subsp. *afromontanum*. Catchment values: The reserves protect part of the Mgeta river catchment. Biodiversity value: Although the reserve is mostly a plantation of exotics, it is possible that some species of restricted distribution have entered the reserve from the adjacent very species rich Uluguru North and South reserves. Bunduki III is a small patch of submontane riverine forest that is of traditional cultural importance, and which may also contain some species of restricted distribution. Timber values: The plantation of *Cupressus* is being harvested by pitsawyers. Human impact: The reserve is largely converted to exotic plantations, some of which are presently being harvested. Firewood and building poles are also taken from the reserve. The reserve is a useful seed source for exotics. Management proposals (Lovett and Pocs): There is a nursery in the reserve which supplies *Cupressus* seedlings for boundary marking for Uluguru North and South F.R.s. The reserve should continue in its role as a source of both exotic timber and seeds, but those areas where natural forest is regenerating or still occurs should not be cleared, especially by springs or along streams. Suitable indigenous species should also be planted, both for timber and seeds. Along the edges of the reserve suitable trees for firewood and building poles for local use should be planted. Bunduki offers potential for conversion to a resource centre for visitors. The old forester's house could be converted into an educational resource centre, whilst the nearby Bunduki Fly Fishing Lodge could offer accomodation to visitors. The reserve could show plantation techniques for a number of exotic species, as well as being close to the extensive natural forests of both Uluguru North and South. Upstream of the reserve there are the spectacular Hululu Falls. Proposed zones: Catchment zone: By springs and along streams. Productive zone: In areas currently under plantation. Amenity zone: In the area around the old foresters house and along selected paths through the forest and upstream along the Mgeta River. Literature: None known, though it is likely that some exists as this was a much visited area at one time.

Appendix 3.2. Description of lowland forest visited on this survey.

Kimboza Catchment Forest Reserve. The reserve is in the eastern Uluguru foothills covering a karst plateau south of Kibungo Mission at an altitude of 300 to 400 m. Access is from the Morogoro to Kisaki road between Mkuyuni and Matombo villages. Area: 4.05 km². Established: 1964. Gazetted boundary length: 11 km. Soils: Tropical rendzina on Precambrian dolomitic marble base rocks. Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Kibungo. Estimated rainfall: 1700 mm/year with groundwater. Dry season: June-August. Temperature: 28°C max. (December), 23°C min. (July). Vegetation: The predominant natural vegetation type is semi-deciduous lowland forest formerly with a 30-40 m high canopy of tall emergents, most of which have now been extracted. Within the forest protruding formations of metamorphosed limestone (marble) are prominent features. Lowland forest: Large trees include: *Antiaris toxicaria*, *Aningeria pseudoracemosa*, *Bombax rhodognaphalon*, *Cordyla africana*, *Elaeis guineensis* (native, up to 20 m tall), *Khaya anthotheca* (formerly *K. nyasicd*) (almost all exploited), *Isoberlinia scheffleri*, *Lettowianthus stellatus*, *Milicia excelsa*, *Newtonia paucijuga*, *Parkia filicoidea*, *Ricinodendron heudelotii* and *Sterculia appendiculata*. In the canopy large nest epiphytes, such as *Platyserium elephantotis* and *Davallia chaerophylloides* are common. A second or third storey is formed by many smaller trees, such as *Cola stelenacantha* and *C. greenwayii*, *Cussonia zimmermannii*, *Dialhim holtzii*, *Drypetes parviflora*, *Filicium decipiens*, *Garcinia livingstonei* and *G. semseii*, *Grandidiera boivinii*, *Ixora tanzaniensis*, *Leptonychia usambarensis*, *Scorodophloeus fischeri*, *Uvariadendron gorgonis* and *Zenkerella egregia*. Near springs and streamlets *Pandanus* cf. *englerii* forms

large stands. The herb layer is often dominated by *Nephrolepis biserrata* and rare aroids such as *Amorphophallus stuhlmannii*, *Anchomanes difformis*, *Calloopsis volkensis*, *Gonatopus boivinii*. On shady limestone on marble rocks an interesting community occurs containing *Zamioculcas zamiifolia* and the endemic *Impatiens cinnabarina*. At the northern edge of the reserve dry, semi-deciduous forests also occur. Along the road *Cedrela* sp. and teak plantation forests are cultivated. Catchment value: There are several springs producing water all year and supplying several streamlets carrying water to the Ruvu River. Biodiversity value: The forest has elements of both the Eastern Arc and coastal forests, and so is rich in species of restricted distribution. Considering the small area, a very high number of plant species are endemic: Two *Asystasia* species, *Baphia pauloi*, *Chassalia discolor* var. *grandifolia*, *Cynometra ulugwuensis* (a tall tree), *Garcinia bifasciculata* (tree), *Impatiens cinnabarina*, *Pavetta crebrifolia* var. *kimbozensis*, *Streptocarpus kimbozana*, and an epiphyllous liverwort: *Cololejeunea jonesii*. Timber values: The valuable timbers Mvule (*Milicia excelsia*), Mninga Maji (*Pterocarpus* sp.) and especially Mkangazi (*Khaya anthoteca* [formerly *K. nyasica*]) were once (in the 1960's) common. Human impacts: Logging has almost completely deprived the forest of its tall canopy trees causing much damage. Most large Mkangazi trees were pitsawn in the early seventies. Large specimens of *Aningeria pseudoracemosa* existed in the late eighties but by now have almost all disappeared. Minor forest products include building poles and medicines. *Cedrela* sp. from nearby plantations has invaded the forest, replacing the indigenous canopy trees. Management proposals (Lovett and Pocs 1993): Valuable timbers such as Mvule and Mkangazi should be regenerated, and invasive *Cedrela* sp. controlled. Woodlots for building poles and firewood should be planted near villages to supply wood products currently supplied by the forest. The reserve has a high biodiversity value with a high species diversity and many endemics. In addition, this type of lowland forest is rare in Tanzania. This suggests the reserve should be conserved and further exploitation prevented. Proposed zones: Catchment zone: To protect stream sides and springs. Biodiversity zone: To cover the whole reserve. Literature: Pocs, T. (1976 a and b), Rodgers *et al.* (1983) (see reference list in Section 8).

Appendix 3.3. Description of forest reserves in the Ulugurus and the nearest vicinity *not* visited on this survey.

3.3.a. Forest reserves on the mountains.

Nyandiduma Catchment Forest Reserve. Location: 8 km from Mgeta. Access is from Mgeta via Nyandira on the Luwale road which forms the upper boundary. The reserve is on a steep east facing slope above the Mbakama river covering an altitude of 1500 to 1600 m. Area: 0.48 km². Established: ?. Gazetted boundary length: 8.5 km. Soils: Sandy brown loams over crystalline gneiss. Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Tchenzema Mission. Estimated rainfall: 1300 mm/year. Dry season: June-October. Temperature range: 20°C max (December), 15°C min. (July). Vegetation: Much of the reserve is a *Cupressus* sp. plantation with some *Acacia melanoxylon*, *Podocarpus* sp. and possibly *Widdringtonia* sp. Small patches of indigenous much disturbed montane forest occur. Second day montane forest: *Albizia gummifera*, *Cussonia spicata*, *Grevillea robusta*, *Dracaena steudneri*, *Ensete ventricosa*, *Halleria lucida*, *Millettia oblata*, *Myrianthus holstii* and *Trema orientalis*. Catchment values: The reserve has limited catchment values, but does not serve to protect some steep slopes from erosion. Biodiversity value: The reserve has no indigenous biodiversity values, but the planted *Podocarpus* sp. and other species might be useful seed sources. Timber values: The planted *Cupressus* sp. is currently being logged. Human impact: The reserve is mostly a plantation. Although still rather small, the *Cupressus* sp. is being harvested by the village because it is infected by pests. 6000 seedlings of *Grevillea robusta*, *Cupressus* sp. and Black Wattle have just (Lovett and Pócs 1993) been planted in the tuangya system. *Albizia gummifera* poles are cut for building. Goats are grazed in the reserve. Management proposals (Lovett and Pócs 1993): The reserve is currently being managed by the District authorities. Most of the upper boundary is marked by a road, but the rest needs to be surveyed and marked. Replanting of timber trees on the reserve should continue, though it may be useful to work out a long term planting and harvesting plan and consider planting some indigenous and multipurpose trees in addition to *Grevillea robusta* and *Cupressus* sp. For example the trial plots established in the 1950ies could be extended. There is a nursery within walking distance of the reserve which is being used to restock the plantations. There is an old foresters house on the reserve which still has good walls but lacks a roof. This could be rehabilitated for a forest attendant. Litterature: None known.

Shikurufumi Catchment Forest Reserve. Location: 20 km from Mgeta. Access is from Mgeta through Langali, Nyandira, Kibuko, Luale to Kidege. The road to the reserve is in poor condition, but the road to Kikeo mission passing through the reserve is in quite good condition and not under heavy pressure. Area: 2.60 km². Established: 1948 or 1937, Gazetted boundary length: 9.1 km. Soils: Sandy brown loams over crystalline gneiss. Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Kibuko Coffee Plantation. Estimated rainfall: 1500 mm/year. Dry season: June-October. Temperature range: 22°C max (December), 17°C min. (July). Vegetation: The reserve is mostly covered by submontane forest, part of which appears to be old secondary growth. The edges of the forest are scrubby regeneration and are probably influenced by fire. In the centre of the reserve is a clearing which may be edaphic or the site of an old village and is now influenced by fire. On the southern edge there is a *Eucalyptus* sp. plantation. Submontane forest: Old secondary area on the top of the ridge have a fairly open canopy 15-20 m high dominated by *Macaranga kilimandscharica* with: *Alangium chinense*, *Albiza gummifera*, *Bridelia micrantha*; *Cussonia spicata*; *Haraungana madagascariensis*, *Polyscias fulva*, *Trema orientalis*. *Afromomum* sp. dominates the herb layer. On more sheltered slopes, more mature areas have a closed canopy 25-30 m high with: *Afrosersalisia cerasifera*; *Entandrophragma excelsum*, *Macaranga capensis*, *Myrianthus holstii*, *Newtonia buchananii*, *Odyndea zimmermannii*, *Parinari excelsa*, *Strombosia scheffleri*, *Trichoscypha madagascariensis*, *Trilepisium madagascariensis*. On the forest edge, scrubby regeneration includes: *Bersama abyssinica*, *Catha edulis*, *Cussonia spicata*, *Macaranga kilimandscharica*. The clearings in the forest is covered with bracken with occasional *Agauria salicifolia* and *Myrica salicifolia*. Catchment values: Shikurufumi stream originates in the reserve and flows through Lukungule village to Mbakana river through Kikeo mission. On the north east side water is taken from the forest via irrigation channels to Kododo Kitongoji Bomo. Biodiversity value: The forest is of the Eastern Arc type and so potentially rich in species of restricted distribution. Timber values: Timber values are low. The only *Entandrophragma excelsum* seen were moribund, and there were few *Newtonia buchananii*. The *Eucalyptus* sp. plantation contains many large trees. Human impact: On the ridge tops the forest appears to be in an old secondary successional stage, and the central clearing in the reserve may be the result of former inhabitation. Local people do not remember cultivation or habitation within the reserve and disturbance may date back several hundred years. The road to Kikeo mission (the Kibuko to Mkinha road as mentioned in the schedule) passes through the reserve, but is no longer used by motor vehicles. Formerly there was a mica mine and small farm on the southern edge of the reserve and this area is still cultivated by local people. There is some cutting for firewood and building poles but this is not extensive. *Eucalyptus* sp. poles are taken for building for regeneration in the *Eucalyptus* sp. plantation. Medicine is taken from the reserve, most notably bark from *Entandrophragma excelsum* and *Myrica salicifolia* trees. . Management proposals (Lovett and Pócs 1993): The reserve is currently being managed by the District authorities. Most of the upper boundary is marked by a road, but the rest needs to be surveyed and marked. Replanting of timber trees on the reserve should continue, though it may be useful to work out a long term planting and harvesting plan and consider planting some indigenous and multipurpose trees in addition to *Grevillea robusta* and *Cupressus* sp. For example the trial plots established in the 1950ies could be extended. There is a nursery within walking distance of the reserve which is being used to restock the plantations. There is an old foresters house on the reserve which still has good walls but lacks a roof. This could be rehabilitated for a forest attendant. Litterature: None known.

Vigoza Catchment Forest Description. Location: 12 km from Mgeta. Access from Mgeta to Nyandira and then to Tchenzema and by foot on the old road to the mission. The Mgeta to Tchenzema road traverses the reserve. The reserve covers a slope above the Vigoza River from an altitude of 1700 m. Area: 0.09 km². Established: 1947. Gazetted boundary length: 1.7 km. Sandy brown loams over gneiss. Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Tchenzema. Estimated rainfall: 1200 mm/year. Dry season: June-October. Temperature range: 20°C max (December), 15°C min. (July). Vegetation: The reserve was formerly a *Cupressus* plantation which was harvested and is now a vegetable garden. There is a *Polyscias fulva* tree still standing in the reserve. Catchment values: The reserve is bounded by the Vigoza river on the north west side and the Mhongolo river on the south side. Reforestation would help control runoff and soil erosion into these rivers. Biodiversity value: No biodiversity value. Biodiversity values: No biodiversity values. Timber values: None. Human impacts: The reserve is a cultivated field. The Mgeta to Tchenzema road traverses the reserve. Management proposals (Lovett and Pócs 1993): The boundary of the reserve is marked with *Cupressus* sp. There is an old foresters house in the middle of the reserve which could be used by a forest attendant. The reserve should be planted with a mixture of *Grevillea robusta* and *Pinus* spp. for timber, and Black Wattle for fuelwood, charcoal and building poles. Proposed zonation: Productive zone. Litterature: None known.

Kasanga. Area: ?? km² (the reserve which is mentioned in Section 5 and was shown on our Figure 1.3 was not mentioned in Lovett and Pócs 1993). Location: At 700-900 m in a stream ravine below Ukwama village.

3.3.b. Forest reserves in the foothills.

Ruvu Catchment Forest Reserve. The reserve is in the eastern Uluguru mountain foothills, covering a plateau on both sides of the Ruvu River gorge at an altitude of 200 to 480 m (Lovett and Pócs 1993). The forest is one of the largest remaining lowland forests in East Africa. However, it is very poorly known, biologically (editors remark). Area: 30.9 km², but 29.8 km² on Jb 2065. Established: 1955. Gazetted boundary length: 29 km. Soils: Tropical rendzina on dolomitic marble (in the western half) and red ferralitic latosols on Precambrian granulite and gneiss (in the eastern half). Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Kibungo. Estimated rainfall: 1800 mm/year on the western edge with peaks in December and May, decreasing rapidly eastwards. Dry season: July to September on the western edge, longer in the east of the reserve. Temperature: 28°C max. (December), 23°C min. (July). Vegetation: The western half of the reserve is covered with seasonal lowland forest (peat bog at the Ruvu river spring) similar to that of Kimboza F.R., but with fewer species. Lowland forest: Canopy trees includes: *Albizia gummifera*, *Khaya anthotheca* (formerly *K. nyasica*), *Milicia excelsa*, *Parkia filicoidea*, with *Barringtonia racemosa* on the stream bank. Smaller trees include: *Scorodophloeus fischeri* with *Acridocarpus cf. scheffleri*, *Meineckia fruticans*, *Pycnocomma macrantha*, *Rawsonia reticulata*, *Afrosersalisia cerasifera*, *Diospyros* sp. Shrubs include: *Dorstenia cameruniae* and *Psychotria cf. riparia*. Catchment values: The area protects the banks of the Ruvu River, and is part of the catchment. The Ruvu River supplies Dar es Salaam with water. Biodiversity value: The forest is of Eastern Arc and coastal forest type and so will be rich in species of restricted distribution. An Eastern Arc endemic is *Pycnocomma macrantha*. *Rawsonia reticulata* occurs here below its normal altitudinal range. Ruvu Forest Reserve might also be an important link in the chain of coastal lowland forests. Timber values: Mkangazi (*Khaya anthotheca* [formerly *K. nyasica*]), Mvule (*Milicia excelsa*) and *Albizia gummifera* occur in many places in the reserve, the soil cover removed and the whole area much disturbed by the digging. Human impacts: The most serious disturbance in the forest is caused by ruby mining as the reserve is one of the most important localities for this gemstone in Tanzania. Licensed mining causes much damage, but is restricted to a licensed area. Unlicensed mining is carried out in many places in the reserve, the soil cover removed and the whole area much disturbed by the digging. Encroachment for small scale farming and fire also causes damage near the villages of Kibungo and Kibangile. Management proposals (Lovett and Pócs 1993): Proper boundary planting and regular patrolling is essential. Due to the gemstone mining business much stronger guarding is necessary. Proposed zones: Catchment zone: On steeper slopes and stream banks. Biodiversity zone: To cover an area determined by survey. Productive zone: For licensed mining. Timber extraction. Literature: None known.

Chamanyani and Mvuha Catchment Forest Reserve. Location: 30 km from Kimboza. Access is from the Kimboza to Mvuha. road which traverses Chamanyani F.R. near the eastern boundary, and by foot up the southern side of the Mvuha River to Mvuha F.R. The reserve covers hilly country to the east of the Uluguru Mountains and part of the Mvuha river valley from an altitude of 140 to 400 m. Area: 15.06 km². Established: During German administration. Gazetted boundary length: Not schedule, estimated to be 48 km. Soils: Brown sandy soils over crystalline gneiss under woodlands with more humus and occasional flooded sandy loams in the Mvuha valley. Richly calcareous slopes are recorded from the eastern side of Bewa Hill. Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Bwakira Juu. Estimated rainfall: 1400 mm/year. Dry season: June to September. Temperature: 28°C max. (December), 23°C min. (July). Vegetation: Most of the reserve is covered by woodland or wooded grassland, the more open areas of which appear to be maintained by fire. Valleys and valley heads are forested. Buffalo occur. Woodland: Trees 5-10 m tall with: *Albizia versicolor*, *Brachystegia boehmii*, *B. spiciformis*, *Cassia abbreviata*, *Pterocarpus angolensis*, *Sclerocarya caffra*. Riverine forest: Canopy 20-25 m with: *Antiaris toxicaria*, *Khaya anthotheca* (formerly *K. nyasica*), *Milicia excelsa*, *Ricinodendron* sp., *Sorindeia madagascariensis*, *Sterculia appendiculata*. Catchment values: The reserve protects a number of small catchments feeding into the Mvuha river, and the banks of the Mvuha river itself. There are some seasonal water courses in the woodland. Biodiversity value: The woodlands are composed of widespread species, but it is likely that the riverine forests contain some Eastern Arc and coastal forest species of restricted distribution. The Red Colobus (Mbega Mekundu) was reported by the local forester to Lovett and Pócs (1993) but was not seen during their visit. If it occurs then it is an important indicator of high biodiversity. The species is not known from any localities between Zanzibar and the Udzungwa Mountains. Timber values: Mkangazi (*Khaya anthotheca* [formerly *K. nyasica*]),

Mvule (*Milicia excelsa*), occur, but most have already been exploited. Besides the river there is a small trial plot of Mkangazi. Human impact: Mvule and Mkungazi were extracted from the reserve many years ago. More recently the reserve was encroached due to lack of boundary marking. Building poles and firewood are taken for local use. Fire occurs every year. Ancient graves are marked on the 1910 border map on the western side of Mvuha F.R. Management proposals (Lovett and Pócs 1993): South of the Mvuha the eastern boundary is marked by *Cedrela* sp. Otherwise the boundary needs to be cleared and planted. Mvule and Mkangazi need regenerating in the riverine forest areas; and the trial plot for Mkangazi assessed and extended. In the woodlands enrichment planting of Mninga should be carried out. fire needs to be controlled and building pole and fuel wood plantations established on boundaries in areas of high population. Proposed zonation: Catchment zone: On steeper slopes of valley heads. Productive zone: Following regeneration of Mvule, Mkangazi and Mninga; and establishment of building pole and fuelwood plots. Biodiversity zone: Following further survey on existence of Red Colobus and location of species rich riverine forest areas. Litterature: None known.

3.3.c. Forest reserves on the plains east of Ruvu River.

Mkulazi Catchment Forest Reserve. Location: Access is from Mvuha to Magogoni, across the Ruvu river by foot at Kiganela and then along the Mkulazi path, or by road from Ngerengere. Area: 686 km². Established: ?. Gazetted boundary length: Not schedule. Soils: Sandy soil. Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Tunuguo, Ngerengere Agriculture. Estimated rainfall: 1000-1500 mm/year with some ground water. Dry season: June to September. Temperature: 28°C max. (December), 24°C min. (July). Vegetation: The reserve is covered by woodland (trees to 10 m tall) with thicket on termite mounds and taller, dense vegetation in areas of groundwater. Woodland: Trees to 10 m tall. Dominated by *Brachystegia spiciformis* with: *Azelia quanzensis*, *Dalbergia melanoxylon*, *Hexalobus monopetalus*, *Hyphaene* sp. *Pteleopsis myrtifolia*, *Pterocarpus angolensis*, *Vitex* sp. and *Xylothea tettensis*. Catchment values: Although not of major catchment importance the ground water table is close to the surface and the reserve is source of the Lulongwe and Mkulazi Rivers. Biodiversity value: The vegetation is composed of widespread species. There may be stands of valuable timber species worth protecting as seed sources. In addition: Buffalo and elephant occur. Timber values: Although there has been logging recently, the reserve is reported to still contain stocks of Mninga *Pterocarpus angolensis*, Mpingo *Dalbergia melanoxylon*, Msekeseke and *Azelia quanzensis*. Human impact: Valuable timber species have been recently extracted from accessible areas of the reserve and adjoining land. Footpaths cross the reserve and it is subject to fires every year, otherwise it is in a remote area with a low population density. Management proposals (Lovett and Pócs 1993): The boundaries are marked with cement beacons and direction trenches, and some low density boundary planting would be useful to make the borders clear. The reserve has potential for production and valuable timber species need to be regenerated and enrichment planting done. Proposed zones: Catchment zone: Over water sources along stream and river banks. Productive zone: Regeneration and enrichment planting of Mninga, Mpingo, Msekeseke and *Azelia quanzensis*. Litterature: None known.

3.3.d. Forest reserves on outlying hills.

Mkunwe Catchment Forest Reserve. Location: 15 km from Mikese, 3 km east of Kikundi village. Access is from Mikese on the Mikese to Madamu road. The reserve covers an isolated hill at the north east edge of the Uluguru Mountains from an altitude of 800 to 1104 m. Area: 19.67 km² (variation initiated in 1982 for a larger area of 56.45 km², but not yet legally finalised [Lovett and Pócs 1993]). Established: 1954. Gazetted boundary length: 30 km. Soils: Ferralitic latosols developed on Precambrian gneiss and granulite rock. Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Tegeteto Mission. Estimated rainfall: 1700-2900 mm/year on the wetter eastern slopes, mist effect on the summit. Dry season: Not marked, on the eastern side, 2-3 months on the western side at lower altitudes. Temperature: 24°C max. (December), 19°C min. (July). Vegetation: Submontane forest (canopy tall with emergent trees up to 50 m!) covers the largest part of the reserve, with transitions to lowland rainforest below 800 m. Dry forest (canopy to 10 m) occupies some lower side ridges on the western slope, where the soil is shallow. Woodland occupies the lower slopes below 700 (to 400) m altitude. Submontane forest: Canopy tall with emergent trees up to 50 m, with: *Allanblackia stuhlmanii*, *Cephalosphaera usambarensis*, *Cylicomorpha parviflora*, *Isobertinia scheffleri* and *Newtonia buchananii*. In the lower part of the canopy *Allophylus pervillei*, *Drypetes natalensis* and *Polyceratocarpus scheffleri* occur. In the transition to the lowland rainforest *Tetrapleura tetraptera* and *Zenkerella egregia* occur. In the ground layer *Aneilema*

aequinoctiale, *Leptaspis cochleata*, *Nephrolepis biserrata* and *Pollia condensata* are typical. Dry forest: Canopy to 10 m with *Bequaertiodendron natalensis*, *Manikara* sp., *Scorodophloeos fischeri*. Undergrowth with xero-tolerant ferns such as *Pella doniana*, *P. adiantoides*, *Phymatodes scolopendrium* and *Davallia chaerophylloides*. Woodland: Dominated by *Brachystegia boehmii*, *B. microphylla* and *Vitex doniana*. Catchment value: The reserve is part of the Ruvu river catchment. About nine streamlets carry water from the reserve, supplying Nyagule, Kikundi, Kibungo, Kidugalo and Lukangazi settlements, and Lusanga Estate with water. Around Kikundi many small scale rice fields are irrigated with the water. Biodiversity value: The forest is of the Eastern Arc type and is rich in species of restricted distribution. Examples of Eastern Arc endemics include: the trees *Cephalosphaera usambarensis*, *Polyceratocarpus scheffleri*, and several Acanthaceae e.g. *Hypoestes forskalii*, *Justicia fittonoides*, and *Stenandriopsis warneckeii*. In addition Elephant and buffalo occur. Timber values: *Cephalosphaera usambarensis* and *Newtonia buchananii* are valuable timbers. Human impact: In the central area of the forest *Newtonia buchananii* is under exploitation by pitsawing. Bushfires occur in the woodland every year and often damage the edge of the closed forest, which is therefore retreating. Encroachment or grazing was not observed. Management proposals (Lovett and Pócs 1993): The boundaries need to be cleared and planted. Boundary plantations of building poles and fuelwood could supply some local needs. Exploited areas should be regenerated. Proposed zonation: Catchment zone: Covering the steeper slopes, streamsides and ridges. Biodiversity zone: To cover the forest. Productive zone: Boundary planting for building poles and fuelwood. Litterature: Pócs (1976a).

Nguru ya Ndege Catchment Forest Reserve. Location: 10-15 km from Morogoro. Access is from the Morogoro to Dodoma road. The reserve covers the slopes and ridges of an isolated hill north of the Uluguru Mountains on the west side of the Morogoro to Dodoma road from 700 to 1357 m. Area: 36.14 km². Established: ? Gazetted boundary length: 25 km. Soils: Shallow lithosols are formed on the upper slopes and ferrallitic latosols on the lower slopes under woodland. At the base of the hill, where sady alluvial deposits are widespread, arenosols cover a large area. The parent rocks are Precambrian muscovite-biotite migmatites and hornblend gneisses Climate: Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Kingolwira and Morogoro. Estimated rainfall: 850 mm/year over woodland; 1500-1800 mm/year with mist effect over forest. Dry season: June-October Temperature: 25°C max. (December), 20°C min. (July). Vegetation: Woodland (canopy 7-25 m tall) is the main vegetation type on all slopes and covers about 60 % of the reserve area. On the summit submontane forest occurs. On the foot of the hill, around the 600 m contour line, remnants of once more widespread rich dry semi-evergreen forests occur. The steep rock towers and cliffs bear an interesting vegetation rich in endemics. Woodland: Canopy 7-25 m tall, dominated by *Brachystegia microphylla*, *B. boehmii* and *Julbernardia globifolia*. Other trees include: *Albizia harveyi*, *A. versicolor*, *Brachystegia spiciformis*, *Dalbergiella nyasae*, *Parinaria curatellifolia*, *Pericopsis angolensis*, *Pterocarpus angolensis*, *Sterculia africana*, *S. quinqueloba* and *Xeroderris stuhlmannii*. The shrub layer contains: *Ozoroa reticulata*; *Heteromorpha arborea*, *Steganotenia araliacea* and *Pavetta crassipes*. On both south west ridges between 800 and 1100 m there are stands of *Monotes elegans*. Above 800 m on east facing slopes there is a mist effect and rainforest epiphytes occur on the branches of the woodland trees, for example: *Polystachya isochiloides*, *Oberonia disticha*, *Peperomia* spp. and *Lycopodium* spp., *Belvisia spicata*, *Drynaria laurentii* and many bryophytes. Submontane forest: Dominated by *Newtonia buchananii* with *Cassipourea gummiflua* and *Antidesma venosum*. The forest goes down the northern valley where it is dominated by *Albizia gummifera* and *Bequaertiodendron natalensis* with *Canthium guenzei*, *Phonix reclinata*, *Crassocephalum manii* and a *Disopyros* species. Dry forest: With *Alzelia quanzensis*, *Commiphora madagascariensis*, *Obetia radula* and *Euphorbia candelabrum* in the canopy and with many other succulents in the lower strata. Rock and cliffs: On the cliffs *Coleochate microcephala* forms a community, while on the rock summits *Aloe morogoensis* is dominant. At the edge of the rock and forest edge *Lobelia morogoensis* occurs in the two places. Catchment values: Only very local with no permanent watercourses, though there will be a contribution to groundwater. Biodiversity values: The *Monotes elegans* stand in the reserve has a high seed production every year and so could be important in seed production and breeding of this prospective timber species. The many endemics of the huge rock faces have high genetic and conservational value. Timber values: *Newtonia buchananii* in the summit forest, *Brachystegia* spp., *Monotes elegans* and *Pterocarpus angolensis* in the woodland and *Azelia quanzensis* in the dry forest. Human impact: Fires occur every year on the slopes, pushing back the edge of closed forest. The north west slope of the summit is already completely deforested. The fires also damage many trees in the woodland. The lower slopes are being deforested for charcoal making. There is encroachment near villages. Management proposals (Lovett and Pócs 1993): Boundary marking and planting is needed to stop encroachment. Patrolling needed to stop illegal logging and unnecessary burning. Fire control is needed to allow regeneration of the forest and woodlands. Woodlots should be planted on the lower slopes to provide fuelwood and building poles to the local villages and for charcoal production. Enrichment planting with Mninga should be carried out in the woodlands. Proposed

zonation: Catchment zone: Steeper slopes and ridge tops. Biodiversity zone: Vegetation of the rock faces. A *Monotes elegans* stand. Productive zone: Woodlots on lower slopes. Woodlands following enrichment planting. Litterature: Pócs (1976a and b).

Mindu Catchment Forest Reserve. Location: 6 km west of Morogoro. Access is from the main Morogoro to Mikumi road or from Mafiga. The reserve covers an isolated ridge at the north western end of the Uluguru Mountains above the Mindu reservoir to an altitude of 1260 m. Area: 22.85 km². Established: 1954. Gazetted boundary length: 20.7 km. Soils: The foot is covered by alluvial sand and sandy loam deposits (up to 600 m). The rocks are muscovite-biotite migmatites and hornblende gneisses of Usagaran (Precambrian) age. The slopes are steep, but the base rocks are exposed only at a few places, above Mafiga and Kasanga. Climate: Oceanic rainfall with oceanic temperatures. In the rainshadow of the Uluguru mountains. Nearest rainfall station: Morogoro. Estimated rainfall: 800-1500 mm/year with a mist effect on the summit. Dry season: June-October. Temperature: 25°C max. (December), 20°C min. (July) at lower altitudes. Vegetation: Wetter woodland covers about 50 % of the reserve area on the slopes and ridges. The tree cover, when disturbed, reaches 70 %. Dry woodland covers about 20 % of the area at the base of the hill and has a tree cover of not more than 40-50 %. Dry semi-evergreen lowland forest covers about 20 % of the area and has 85 % tree cover (canopy of varying height from 10 to 30 m). It has survived in, and is presently restricted to, the fire protected gorges and to parts of the slopes where gullies act as firebrakes. Submontane evergreen forest remains only in fragments on the summit ridge (2 %), replaced mainly by secondary grassland (4 %) as after logging and fires. Rock outcrops occupy less than 4 % of the area. Woodland: Dominated by *Brachystegia microphylla*, *B. spiciformis* and *Julbernardia globiflora* with *Xeroderris stuhlmanni*. *Uapaca sansibaricus* forms almost pure stands on the southern and of the summit ridge. The loose sandy soil at the base of the hill below 600 m is covered by dry *Combretum* woodland and wooded grassland. The trees are scattered, bushy, 6-8 m tall. In valleys, *Acacia nigrescens* and *Sclerocarya caffra* dominate. On ridges and drier sites *Combretum* and *Markhamia* sp. dominate. Dry lowland forest: The canopy is of varying height from 10 to 30 m. Evergreen trees include: *Azelia quanzensis*, *Cussonia zimmermannii*, *Euphorbia nyikae*, *Parkia filicoidea*, *Scorodophloeus fischeri*. Deciduous trees include: *Albizia glaberrima*, *A. versicolor*, *Brachystegia microphylla*, *Ricinodendron heudelottii*, *Tamarindus indicus* and *Terminalia sambesiaca*. Submontane forest: The multilayered canopy is dominated by *Newtonia buchananii* and tangled by many climbers. Rock vegetation: Vegetation on cliffs and rock summits is dominated by the dwarf bush *Xerophyta scabrata* and is a community rich in rare and endemic species. Catchment values: Surface watercourses are seasonal and dry up during the dry season. During the rains (and in form of underground runoff) Mindu Hill supplies water to the Ngerengere River, which is important in supplying water to Morogoro township. Mindu Hill also supplies water to the Mindu water reservoir in the Ngerengere valley under its south eastern slopes. Biodiversity value: The forest is of the Eastern Arc type and so contains species of restricted distribution. The biodiversity value of the reserve are concentrated in certain vegetation types. The submontane forest fragments on the summits have an undergrowth of gingers (*Aframomum angustifolium* and *A. usambarense*), both rare species and the latter so far otherwise only known from the Usambara Mountains. The upper, mist effected belt of miombo woodland is rich in epiphytes with rare orchids such as *Polystachia isochiloides*, *P. fischeri*; ferns such as *Belvisia spicata*; and interesting mosses and liverworts such as *Squamidium brasiliense*, *Rhodobryum perspinidens*, *Macromitrium tristatosum*, *Schlotheimia schweinfurthii*. The moss *Frullania* spp. occurs in large masses and is important in mist interception. In the dry semi-evergreen forest *Grewia forbesii* (a climbing shrub), *Polysphaeria braunii* (a shrub) and *Commiphora madagascariensis* (a medium sized tree) are rare species restricted to coastal Tanzania. In the open woodland rare bulbiferous plants occur, for example *Amorphophallus goetzei*. The granitic rock outcrops are also rich in rare species, for example *Aloë morogoroënsis* occurs in large clumps. Timber values: There are few valuable timbers, with the exception of some Mninga (*Pterocarpus angolensis*) and Mpingo (*Dalbergia melanoxylon*) in the wetter woodland. Less valuable species represented in the reserve include: In the dry *Commiphora* spp. woodland: *Acacia nigrescens*, *Pteleopsis myrtifolia* and *Sclerocarya caffra*. In the wetter woodland: *Brachystegia spiciformis* and *Sterculia quinqueloba*. In the dry forest: *Azelia quanzensis* and *Ricinodendron heudelotti* and – to some extent *Albizia versicolor*. Human impact: Charcoal making and regular burning have a serious impact on the wetter woodland. During the past five years the canopy has disappeared or reduced from 70 to 20 % on the lower slopes between 600 and 800 m altitudes. Mining takes place on the lower slopes, with stone quarries and sand mines near the main road. Loose soils from the mines currently washes out onto the highway. In particular, sand mines have devastated large areas just behind Mafiga village. Cultivation does not take place on the slopes and grazing (goats) is very limited. Management proposals (Lovett and Pócs 1993): Border planting is needed on the south eastern side facing the town and highway. Easy access to the main highway and proximity to Morogoro result in exploitation for charcoal and regular burning. Intensive patrolling is needed to control this situation. With exclusion of fire,

secondary grassland on the summit ridge would regenerate into closed forest. Gaps in the woodlands should be enriched with *Mninga* or *Brachystegia* spp. Fuel wood and building pole plantations should be established on the lower slopes. Erosion from mining areas should be controlled by establishing a forest cover consisting of *Acacia albida*, *Leucaena leucocephala* and *Eucalyptus* spp. If the trend of deforestation continues, there is a real danger that not only the catchment and timber production will suffer but also large scale soil erosion will take place on the steep slopes. Proximity to Morogoro also gives the reserve amenity value for education and recreation. **Proposed zones:** **catchment zone:** Steeper slopes and upper ridges. **Biodiversity zone:** Submontane forest, epiphyte rich woodland on upper ridges, and rock face vegetation. **Productive zone:** Fuel wood and building pole plantations on the lower slopes. Wetter woodlands following enrichment with valuable species. **Amenity zone:** Suitable path to the summit ridge. **Litterature:** Kayambazinthu (1989) (see reference list of Section 3), Pócs (1976a and b) (see reference list of Section 8), Pócs (1980) (see reference list of Section 9).

Dindili Catchment Forest Reserve. **Location:** 25 km east of north east of Morogoro town. **Access** is from Mikese village on the Morogoro to Dar es Salaam road. The reserve covers a north-south running ridge north of Mikese to an altitude of 849 m. **Area:** 10.06 km². **Established:** 1953. **Gazetted boundary length:** 15.3 km. **Soils:** Acidic lithosols and ferralitic latosols on the steeper slopes with deeper deposits of ferruginous sandy clay at the foot. The ridge is built up of Precambrian migmatites and gneisses. **Climate:** Oceanic rainfall with oceanic/continental temperatures. **Nearest rainfall station:** Kingolowira Mission. **Estimated rainfall:** 700-1000 mm/year. **Dry season:** June-October. **Temperatures:** 26°C max. (December), 21°C min. (July). **Vegetation:** Woodland covers about 40 % of the area, mostly the lower ridges and the drier western slopes. Dry evergreen forest covers 60 % of the area on the wetter eastern slopes and summit ridge (tall closed forest with trees up to 30 m in the valleys). Woodland: the canopy is rich in species: *Acacia hockii*, *A. senegal*, *Brachystegia boehmii*, *B. microphylla*, *B. spiciformis*, *Combretum zeyheri*, *Dalbergia melanoxylon*, *Diplorhynchus coldylocarpon*, *Heteromorpha arborea*, *Ozoroa reticulata*, *Pavetta crassipes*, *Pteleopsis myrtifolia*, *Pterocarpus angolensis* and *Sclerocarya caffra*. In the undergrowth *Cyperus hemisphaericus*, *Hyparrhenia rufa*, *Indigofera garckeana*, *Ocimum suave* and *Themeda triandra* are important. Dry forest: Tall closed forest with trees up to 30 in valleys. The trees include: *Brachystegia huillensis* (dominant in many places), *Azelia quanzensis*, *Bombax rhodognaphalon*, *Commiphora madagascariensis*, *C. pteleifolia*, *Diospyrus consolata*, *Erythrina* sp., *Euphorbia candelabrum*, *E. nyikae* (noth *Euphorbia* are tall trees up to 20 m), *Manikara sulcata*, *Pandanus engleri*, *Ricinodendron heudelotii*, *Scorodophloeos fischeri*, *Teclea simplicifolia* and *Vepris eugenifolia*. Shrub and minor trees: *Chazaliella abrupta*, *Croton pseudopulchellus*, *Excoecaria madagascariensis* and *Tarenna nigrescens*. **Catchment values:** Seasonal streams supply water to the relatively densely populated area along Tanzam Highway. There are shallow wells on the eastern foothills for rural water supply. The western slopes drain into the Ngerengere River and the Ruvu River. **Biodiversity value:** The reserve is a typical coastal lowland forest, a forest type which was very much reduced during the last century. A characteristic coastal endemic species (in spite of its name) with a very restricted distribution is *Commiphora madagascariensis*. Species with Madagascan affinities restricted to the coast in mainland Africa include: *Tarenna nigrescens* and *Excoecaria madagascariensis*. The *Brachylaena huillensis* population is valuable as a seed source. **Timber values:** The woodland is quite rich in *Mninga* (*Pterocarpus angolensis*) and *Mpingo* (*Dalbergia melanoxylon*). The dry forest is rich in valuable timber with large quantities of *Muhuhu* (*Brachystegia huillensis*). *Azelia quanzensis* is also a valuable hardwood. **Human impact:** Fires occur regularly in the woodland, especially above Mikese Police Station. Illegal charcoal making takes place close to the main road. The dry forest is relatively intact, except for exploitation of *Brachylaena huillensis* for construction. Traps are set for small forest antelopes. A small amount of encroachment is reported. **Management proposals (Lovett and Pócs 1993):** Border planting is required to control encroachment. Fires in the woodland should be reduced to prevent loss and allow regeneration of closed forest. Illegal exploitation of *Brachylaena huillensis* should be controlled, and coppice regeneration of the *Brachylaena huillensis* maintained and selected to raise good quality timber trees. **Proposed zones:** **Catchment zone:** Steeper slopes and ridgetops. **Productive zone:** Border plantations. Regenerated *Muhuhu* stands. **Litterature:** There should be student field work reports at Sokoine University.

Kitulanghala Catchment Forest Reserve. **Location:** 35 km east north east of Morogoro town. **Access** is from the Morogoro to Dar es Salaam road. The reserve covers a ridge between the main road and the Sanganga river from an altitude of 350 to 774 m. **Area:** 26.38 km². **Established:** 1955. **Gazetted boundary length:** 18 km. **Soils:** Acidic lithosols, ferralitic latosols and ferrisols developed, depending on the depths, over Precambrian gneiss. **Climate:** Oceanic rainfall, oceanic/continental temperatures. **Nearest rainfall station:** Kingolowira Prison. **Estimated rainfall:** 700-900 mm/year. **Dry season:** June-October. **Temperature:** 27°C max. (December), 21°C min. (June). **Vegetation:** Woodland covers about 60 % of the reserve on the lower and higher slopes, except the summit and those parts,

where the spread of fires was prevented by gullies and higher soil moisture. Dry semievergreen forest covers about 30 % of the area, mainly on the eastern slopes and summit. Woodland: Dominant species include: *Brachystegia boehmii*, *B. spiciformis*, *Combretum zeyheri*, *Dichrostachys cinerea*, *Diplorhynchus condylocarpon*, *Julbernardia globiflora*, *Markhamia zanzibarica*, *Pterocarpus angolensis*, *Sclerocarya caffra* and *Spirostachys africana*. Low, open dry, deciduous *Combretum* spp. woodland replaces *Brachystegia* spp. woodland on drier soils and is dominated by: *Acacia nigrescens*, *Combretum apiculatum*, *C. collinum*, *C. psidioides* and *Pseudolachnostylis maprouneifolia*, with dense grass layer. Dry forest: Trees up to 15-20 m tall, forming a dense canopy dominated by *Manikara sulcata* with: *Bequaertiodendron natalensis*, *Croton sylvatica*, *Cussonia zimmermannii*, *Ricinodendron heudelotii*, *Scorodophloeus fiecheri* and *Terminalia sambesiaca*. The cycad *Encephalartos hildebrandtii* occurs as 6 m tall trees with stems 60-90 cm in diameter. In the lower canopy and shrub layer there is an undescribed *Coffea* species, with *Commiphora pteleifolia*, *Grandidiera boivinii* and *Excoecaria madagascariensis*. Catchment values: The reserve is part of the Sangasanga river catchment. There are no permanent surface streams. Underground runoff is collected by streamlets at the foot such as Lubungo stream near Mikese and tributaries of the Ngerengere river. Biodiversity value: Two species occurring here, *Grandidiera boivinii* and *Excoecaria madagascariensis*, are typical Madagascan - coastal East African species with restricted distributions. The cycad stand in the dry forest is one of the largest in the country, with very tall specimens and therefore warrants attention. The still undescribed coffee species (*Coffea* sp. E of Bridson in the Flora of Tropical East Africa) is a unique endemic of the area of potential importance for coffee breeding. It grows on the ridge south of the summit at 550 m, on the border of the dry forest. Timber values: *Pterocarpus angolensis* and *Terminalia sambesiaca* have some timber value. In addition, trial plots of *Cassia siamea* and teak have been established on the eastern foot of the hill along the main road and are doing well. Human impact: Large scale charcoal making is carried out at the northern end of the reserve. The whole woodland area is burnt regularly. Management proposals (Lovett and Pócs 1993): Burning and charcoal making should be controlled. The teak and *Cassia* sp. stands should be managed. Proposed zones: Catchment zone: On steeper slopes. Biodiversity zone: To cover the dry forest, protecting the Cycad stands and *Coffea* sp. population. Productive zone: Teak and *Cassia* sp. stands. Litterature: Kielland-Lund (1982 and 1990) (see reference list of Section 3).

APPENDIX 4 (Study sites).

Appendix 4.1. Notes on map errors (*this is a longer version than the printed version.*)

Map errors sometimes led to much confusion and loss of time when we tried to explain the local villagers where we wanted to go. The following notes can hopefully save future visitors to our study areas for such problems.

Kimhandu area (1:50.000 map number 201/1, updated 1982). The names of the two villages "Nyamigadu A" and "Nyamigadu B" should be interchanged, and it is better to use the synonym "Wembela" for Nyamigadu A (the village shown as "Nyamigadu B" on map 201/1). The area shown as Kimhandu Hill on the 1:50.000 map has the local name Nongwe, and if you ask the villagers where Kimhandu is they will point towards a peak on the high, sharp ridge that forms the watershed between the Msuluzi area and the Wembela/Nyamigadu area. The latter peak is about one kilometer south of Nongwe. **Lanzi area (1:50.000 map number 201/1, updated 1982).** It appears that several small streams in the area are called Sinzine by the local villagers. **Tegetero area (1:50.000 map number 183/3 updated 1970)** The big stream called Zira on the 1:50.000 map is called Kitala by the locals. The stream called Zira by local people appears to be a small tributary of Kitala.

Appendix 4.2. Notes on the occurrence of local paths inside the forest and access to the areas.

Moving around in a forest it is by far easiest to follow the local paths, of which a number intersects the forest reserves. However, the villagers are often quite unwilling to inform newcomers about the occurrence of such paths, possibly because they are aware that their activities inside the forest reserves (except walking through it to visit families etc. in other villages) are illegal. This fact sometimes led us to enter the forest away from paths, leading to waste of time. The following notes can hopefully facilitate planning for future visitors to our three main study areas.

Kimhandu: There is a relatively good footpath from Wembela village running northeast through the forest reserve to Ukwama village. At a junction between two ridges (at 2000 m) this path ramifies, the right path leading to the western part of the Ukwama village area, the left path reaching the eastern part of the Ukwama village area close to the lower forest reserve boundary. A smaller path runs from Ukwama village up to the Nongwe area (Kimhandu Hill area, 2635 m). A fast walking person (without luggage) can walk from Ukwama to the Nongwe area in approximately 1.5 hours.

Lanzi: There is a path from Lanzi village up to the forest edge near the stream Sinzine and continuing through the forest (as a narrow path) up to a large meadow area next to the Mgeta River at c. 1860 m. The path ramifies into a few other paths, but these are seldom used and regrowth is commencing in some places. There is a path from Nyingwa village up to the northern end of the Lukwangule Plateau. Possibly, it is connected to a path to the Tchenzema Mission on the western side (the latter was followed on 28 and 29 October by JF and JK at the Tchenzema side).

Tegeteros: Two wide and well used paths intersect the study area: One runs southwards (after having crossed a pass) from Morningside to the village Rukwe which is situated south of the forest reserve. At 1530 m the Morogoro-Rukwe footpath is crossed by another big footpath, the Luhungo-Kinole/Bagiro/Tegetero trail. This last trail runs east-west and connects Luhungo village west of the forest reserve with the villages Bagiro, Kinole and Tegetero east of the forest reserve (branching in the eastern end). Walking fast, it should be possible to walk from Tegetero village to Morogoro city in one day, following first the path towards Luhungo and then turning right towards Morningside at the junction. The paths are used for visiting families in other villages and for carrying market items to and from Morogoro. We met people on these paths now and then near the Tegetero-2 camp and probably others passed unnoticed.

Access to the Kitandulu area and to the Wembela and Ukwama villages. There are two ways of reaching this area by car and we tried both. From Morogoro city you can drive to Singiza Mission by car following the Morogoro-Kisaki gravel road to Dakawa where you turn right and follow a dirt track to Singiza Mission. From Singiza (440 m) there are several foottracks to the small highland villages near the southernmost part of the Uluguru South F.R. (c. 1500 m). The walk uphill from Singiza to the Kitandulu on the southwest area (1540 m) took us seven hours. After a few days in the Kitandulu area we moved to the gradient along the Msuluzi River (above Ukwama village) where we spent the rest of the month. We left the Msuluzi area by walking from Ukwama village (1430 m) to Kolero village to where there is a good road. Given the present road conditions we recommend the route via Kolero. There is a big weekly

market in Kasanga. **Access to Lanzi village.** Leaving the Morogoro-Kisaki road a bit north of Matamba village, it is possible to drive all the way to Lanzi (900 m). Access to Lanzi by foot is principally via a footpath from Matamba (circa two hours of walk). This path is frequently used by the locals when they go shopping or visit family in Matamba and Morogoro. From Matamba you can catch the Kisaki bus to Morogoro and it is also possible to travel in the small Landrovers that currently run between Morogoro and Matamba. **Access to Kinole and Tegetero villages.** Leave the Morogoro-Kisaki gravel road a few kilometres before Matamba and follow the road towards Lanzi. After some kilometres you turn right, now heading towards Kinole (connected with Sangasanga village and probably the most safe/correct name to be used if one wants to go to this area) where the road ends. From Kinole we walked to the Tegetero mission from where we entered the forest. Future visitors should note that it is much easier to follow the Kinole-Luhungo path into the forest. We used that path to Kinole when leaving the forest. The Tegetero villagers are currently constructing a road (for cars) from Tegetero Mission to Kinole village, meaning future possibilities to go by car all the way to Tegetero. The road is being dug without using machines by most of the villagers who work on the project each Monday (Monday is the common Villagers Working Day of Tegetero). There is daily connection from Kinole village to Morogoro city with small Landrover taxis (same type as the ones mentioned earlier between Morogoro and Matamba). Kinole has a large market with lots of small stands and at least one big weekly vegetable market day.

Appendix 4.3. Notes on the position of field stations.

The position of our camps is shown on the maps in the introductory section of this report. Below we give some extra details, which will hopefully make it possible for future visitors to the areas to know relatively exactly where we camped. For many of the earlier ornithological surveys in the Eastern Arc it is a general problem that the exact localities for the study or the collection of specimens has not been described. **Kimhandu-6 (1540 m):** Our first camp in the Kimhandu area was in a forest section with the local name Kitandulu, at 1540 m, not far from the Nyamigadu B village (Nyamigadu A on the topographic map). It was not part of our plan to spend time here but because of the interchange of the names Nyamigadu A and B on the 1:50.000 m maps the local porters led us on a "wrong" path, and since it was late we decided to make a preliminary camp in the Kitandulu for a few days before continuing to the Msuluzi River where we had planned to work. **Kimhandu-1 (1520 m):** Situated close to Msuluzi River on a steep slope. **Kimhandu-2 (1710 m):** This camp was on a sharp ridge some 500-700 m south of Msuluzi River using one of its tributaries as water source. The tributary joins Msuluzi River at 1600 m. **Kimhandu-3 (1940 m):** Situated very close to the Wembela-Ukwama path (branch to western part of the Ukwama area) c. 500-1000 m north of the branching point (see Appendix 4.2). Several ridges meet in the area which has the character of a plateau. **Kimhandu-4 (2145 m):** Situated well north of Msuluzi River (the river is far down in the valley and not audible or visible from this camp) next to the path from Ukwama village to Nongwe Peak (on the 1:50.000 topographic map this peak is called Kimhandu Hill, reaching 2634 m). A wide stream with the local name Kipalu runs close to the path here. The area around the camp and mistnets was relatively flat, almost plateau-like, on a wide ridge. **Kimhandu-5 (2520 m):** Situated at the spring of Msuluzi River. There is a large meadow (shown on the 1:50.000 map) with tall alpine grass and scattered but impenetrable bushes. The local name of the highest top (2634 m) and the areas in its vicinity is Nongwe (see Appendix 4.1). **Lanzi-1 (1710 m):** Situated 200 m inside forest next to a stream with the local name Sinzine (remark: from what we could find out also other small streams in the area are called Sinzine) and next to the path we arrived by (path from Lanzi village to meadow at 1860 m). **Lanzi-2 (1920 m):** Situated along the same path as Lanzi-1 on a long and relatively narrow ridge, 25 minutes of walk from Lanzi-1 and 1-2 hours of walk from Lanzi-3. **Lanzi-3 (2110 m):** To reach this station you have to cross the river Mgeta at a big meadow at 1860 m. From this meadow we followed Mgeta River upstreams for c. 700 m, then crossed it and walked in a narrow tributary for a few hundred meters north before following the ridge up to the camp area. Camp was at 2000 m, 20 minutes walk from the working area at 2110 m. **Tegetero-1 (1345 m):** Situated around 1 km south of the east-westwards oriented path from Tegetero to Luhungo (see Appendix 4.2) and therefore also some distance south of the Kitala River (see Appendix 4.1). 1-2 hours of walk from Tegetero village. **Tegetero-2 (1535 m):** Situated at the junction between the Morningside-Rukwe and the Luhungo-Kinole/Bagiro/Tegetero path. **Tegetero-3 (1710 m):** Situated next to the Luhungo path near an area where you cross three small streams. **Tchenzema:** No camps in the forest, staying overnight at the mission in Tchenzema. **Kigurunyembe:** Camped inside forest at 700 m and surveyed forest and edge habitats from 600 to 850 m in the forest strip.

Appendix 4.4. Illegacies observed in the forest reserves during the survey (*new section not part of the printed version*).

Below we give information on illegal activities observed in the forest reserves during our survey. In general the local people probably avoid visiting the forest while there are “strangers” working there.

Kimhandu area: Generally we saw few trails or cutmarks on the tree trunks, except in the lowest parts. On a walk in lower forest parts in the Ukwama area up to 1-1.5 km north of Msuluzi River the general impression was that the lower parts of the forest here were of secondary character (though spectacular locally): Many cutmarks and tree stumps from felled trees, and hardly any Camphor *Ocotea usambarensis* left in the lowest parts. Gunshots were heard on a single occasion from the lower part of the forest near the Msuluzi river. We were told that the shots were fired by a person hunting Blue Monkeys *Cercopithecus mitis*. This species is hunted because of the damage it does to the crops, e.g. maize and beans. On the grassy meadow at 2520 m many old and now unused traps were found. **Lanzi area:** (Quite a lot of clearing had taken place recently at the lower forest edge. Near Mdogo stream somewhat north of our Lanzi-1 station an area of around one hectare was seen with lots of big trunks felled recently, the area having been burnt also. The area had clearly been felled for agricultural purposes. We are not sure, however, whether the clearing took place inside or just outside the forest reserve). Hunters with dogs were heard near our camp at 2000 m. A fireplace and a levelled sleeping place used by hunters were found next to a big rock not far from the 2110 m station. Here were also tracks of an old camp established years ago. An area at 2110 m, c. 500-700 m², had been cleared for herbs and apparently prepared for planting *bangi* (local name for marijuana and the like). This *bangi* field was several hours of walking from the nearest human settlement but close to the above mentioned hunters sleeping place. It was also close at some very big forest glades with bracken, well inside forest, indicating that years ago there might have been some human settlement and cultivation in this very remote area (probably before the establishment of the forest reserve? According to Lyamuya *et al.* 1994 there were people living inside the forest reserves before the gazettelement of the reserves. These people were forced to move out of the forest). **Tegetero area:** Six strong snares made of nylon rope were found near the Tegetero-3 station. Some big trees had been felled, one of them (> 70 cm diameter) had been felled only for honey harvesting. Pole cutting takes place. (Some old pitsawing holes were seen). (A lorry was seen leaving the Kinole village with timber. Unfortunately lack of time restricted us from finding out where the timber came from). **Tchenezema:** Strong disturbance inside the forest, much cutting and no big trees. People are aware that the forest is protected but cut what they can. The forest guards live far away and do not usually come to see how people manage the forest.

Appendix 5. ORNITHOLOGY

Appendix 5.1. Earlier ornithological survey work in the Uluguru Mountains.

The reader of this account should bear in mind that very few of the earlier papers give any clue about the intensity of the research at study sites, and much uncertainty exists about the exact study sites in the older literature. We cannot guarantee that the list of earlier activities in the appendix is complete but hope that the account serves to give an overview.

The first ornithological collections date from the 1890's. Specimens from the eastern part of the Ulugurus, including Mhonda, were collected by Stuhlman and delivered to the Museum of Berlin. No report was ever compiled from his collections, but 14 species were mentioned in various publications by Reichenow from 1889, 1894, 1895 and 1900-1905 (Friedmann and Stager 1964). In 1913 Ludwig Schuster collected specimens in Bunduki, Nyandiduma and Mamba in the western part of the Ulugurus and in Mseru in the eastern part, but only 14 species were published (Schuster 1926, Friedmann and Stager 1964). Arthur Loveridge visited the Ulugurus at least as early as in 1918 but the only published note from this year is a description of a Paradise Flycatcher nest (Loveridge 1922). In June 1920 C.M.F. Swynnerton collected 69 specimens of 37 species, which were delivered, to the Natural History Museum in Tring, England (Friedmann and Stager 1964). Friedmann and Loveridge (1937) mention that Swynnerton had a local collector.

Serious ornithological exploration of the Uluguru Mountains really began as recently as 1921 and 1922. In May-June 1921 and May-July 1922 Salimu bin Asmani, a trained native collector employed by Arthur Loveridge, made the first sizable Uluguru collections (98 species, of which c. 40 are forest species), chiefly around Bagilo (Friedmann and Stager 1964), which was his home village, but also in other parts of the Ulugurus, including Mbeta (Friedmann and Loveridge 1937, Friedmann and Stager 1964). The major part of this collection is now in the Museum of Comparative Zoology, Harvard University, USA, and was reported on by Friedmann and Loveridge (1937).

In 1926, Loveridge and his (bird) collector Salimu collected 77 species of birds (c. 45 forest species) during a survey where the main emphasis was put on reptiles and amphibians (Friedmann 1928, Friedmann and Stager 1964). One of the species was unknown to science: the Uluguru Bush Shrike *Malaconotus alius*. All specimens later came to the Museum of Comparative Zoology, Harvard University, USA, and were reported on by Friedmann (1927, 1928 and 1929). The specimens were labelled Bagilo (11-28 September), Nyange (1-11 October), Nyingwe⁶ (1 October, 8 October, 13-19 October), Tawa (8 October), Mkaraji (20-22 October) and Vituri (26-29 October) (Friedmann 1928).

In 1937 R. E. Moreau spent some time in Kibungo Forest (a bit north of or synonymous with Kimboza Forest) and Kinole Forest (Moreau 1938, Friedmann and Stager 1964), resulting in the discovery at Kinole of a species unknown to science: Mrs Moreau's Warbler *Bathmocercus winifredae* (named in honour of his wife Mrs Winifred Moreau). Stuart and Jensen (1985) mention specimens collected by Moreau in the Ulugurus "mainly in 1938", most of which are now in the Natural History Museum, Tring, England. Moreau also visited the western part of the Uluguru South F.R. for some few days and later sent his collector Charles Abdallah to the same locality to obtain specimens of an unknown species he had heard there (Moreau 1946). Mr. Abdallah drew the conclusion that the unidentified voice belonged to Mrs Moreau's Warbler *Bathmocercus winifredae*.

N.R. Fuggles-Couchman visited many parts of Tanzania over many years in connection with his job as agricultural officer (Fuggles-Couchman 1939, 1984a,b,c; obituary in *Ibis* 136 p. 109). His selected notes mention a few observations from Mgeta, Kasanga, Mngazi and the eastern foothills (including Kibungo Forest) (Fuggles-Couchman 1939 and 1984a,b,c; Stuart and Jensen 1985).

During twenty years of residence on Tanzanian sisal estates from 1947 to 1967, Thorkild Andersen from Denmark collected skins at various localities (in total at least 11685 specimens of 690 species, Britton 1981). He lived in Morogoro for some years and visited the Ulugurus several times, including Kimboza. Preliminary research on Andersen's work has revealed that he had two local collectors with him at the estate in Morogoro (J. Fjeldså pers.

⁶Nyange and Nyingwe are, according to Stuart and Jensen (1985), other names for Nyingwe (which is south of Lanzi, eastern slopes of the Uluguru South F.R., see Figure 1.4). However, Loveridge (1960) gives altitude (in feet) for some of the specimens collected in Nyange and Nyingwa, and all specimens listed from Nyingwa in his paper are from 2300 m above sea level, whereas all specimens from Nyange are from 750 m above sea level, indicating that the names must represent two different localities although probably in the same area (click on the footnote number to return to text).

comm.). Friedmann and Stager (1964) mention a list Andersen sent them of birds obtained for him in the Ulugurus by his native collectors.

Britton (1978) briefly reviewed 3005 Andersen specimens collected in Tanzania and now stored in museums in Leiden (1749), Stuttgart (971), Basel (280) and New York (5). The ones mentioned from the Ulugurus were labelled: *Bagilo (1800 m)*, *Tegetero (900 m)* and *Uluguru Mountains* (mainly 800-1000 m). Britton (1981) later reported on some Andersen skins stored in Munich (3200) and Bonn (1578), including some from the Ulugurus. He did not, however, report on the skins stored in museums in Copenhagen (3949) although he examined the collection. This was due to an agreement with N. E. Franzmann of ZMUC who already planned to publish on the specimens. Unfortunately, Franzmann passed away before writing anything, but the specimens in Copenhagen will be published within the next few years (Fjeldså and Dinesen in prep.). A sporadic study of the collection in Copenhagen in connection with writing this report revealed that the majority of the Uluguru specimens were labelled *Bagilo 1800 m* or simply *Uluguru Mountains*. There were, however, also a few specimens from the Mgeta area in the western part of the Ulugurus.

The high number of *Bagilo* specimens indicate that Andersen or his collectors spent a good deal of time in this area which is on the eastern slopes of the Uluguru North F.R north of our study area at Tegetero (see Figure 1.5). For some of the forest species labelled *Bagilo 1800 m* this seems an unusually high elevation. Furthermore, some non-forest species, e.g. Waxbill *Estrilda astrild*, Yellow-bellied Waxbill *Estrilda quartinia* and Cape Robin-Chat *Cossypha caffra*, are labelled *Bagilo 1800 m* (Stuart and Jensen 1985) though this area is deep inside montane forest according to our 1:50.000 map, which is based on air photographs from 1964. It is therefore likely that his specimens labelled 1800 m have been collected over a wide elevational range. There may, however, have been a camp inside the forest at 1800 m altitude. In this connection it is interesting that also the *Bagilo* specimens mentioned in Loveridge (1960) were labelled 1800 m. The Andersen specimens labelled *Uluguru Mountains* could be from anywhere in the Ulugurus, since Andersen did not write diaries (J. Fjeldså pers. comm.) and never published anything himself.

Among the most interesting Andersen specimens are at least seven specimens of *Malaconotus alius* collected between 1952 and 1961 (six labelled *Bagilo*; Britton 1981), five specimens of *Anthreptes rubritorques* (the only proofs of its presence in the Ulugurus; Britton 1978 and 1981, Stuart and Jensen 1985), one specimen of *Ploceus nicolli* (Franzmann 1983, Stuart and Jensen 1985) and (Copenhagen specimens only) seven specimens of *Bathmocercus winifredae*. As a curiosity we can mention that Mze Leonard Bansi from Tegetero, whom we employed as a guide on our work west of Tegetero in December 1993, worked with Thorkild Andersen in 1948-49 when 23 years of age.

J.G. Williams, curator of the bird collection of the Coryndon Museum in Nairobi, Kenya, visited the Uluguru Mountains briefly in October 1948 and November 1950 (Williams 1951). Stuart and Jensen (1985) mention visits by Williams between 1948 and 1951. Most of Williams' specimens are now in the National Museum of Kenya, Nairobi, and the Natural History Museum, Tring, England (Stuart and Jensen 1985). One of the localities he visited was Bunduki.

From 22 November 1961 to 15 February 1962 Gerd H. Heinrich collected specimens for the Peabody Museum of Natural History, Yale University, in the lowlands of the Uluguru Mountains around Morogoro and in cloud forests at 1500-2000 m (Ripley and Heinrich 1966, 1969). Ripley and Heinrich (1966 and 1969) later reported on 16 of the species collected, including 13 forest species.

From 6 to 15 January 1964 the Cheney expedition collected specimens (56 species, about half of them forest species) and investigated the area at Bunduki at an elevation of about 1530 m (Friedman and Stager 1964).

January 1980 S. N. Stuart visited Morningside and the northern slopes of Lupanga in the Uluguru North F.R. (Stuart and Jensen 1985). In June-July 1981 Scharff *et al.* (1982) studied the invertebrate fauna (N. Scharff and M. Stoltze) and the avifauna (F.P. Jensen and S.N. Stuart) of the Uluguru Mountains.

The following sites were visited by Stuart and Jensen:

- Uluguru North F.R.: The western side of Lupanga from the forest edge at 1400 m to the peak at 2138 m and down to 1200 m on the eastern side in July.
- Kimboza Forest (lowland forest at 300 m altitude). A three-day visit in July.

- Uluguru South F.R.: The forest above the village Tchenzema was investigated and excursions to the western scarp of the Lukwangule Plateau were made (1900-2400 m) in July.

In September 1982 F. P. Jensen made a brief visit to Lupanga Peak and the eastern slopes of Lupanga down to 1300 m and in November 1984 he made a brief visit to Kimboza Forest (Stuart and Jensen 1985).

Observations from later brief visits to the Ulugurus by N. E. Baker, K. Howell, D. C. Moyer, R. J. Stjernstedt and D. A. Turner were included in Stuart and Jensen's paper from 1985. Their visits include Bunduki and Morningside. We have made no attempt to find out whether the Ulugurus have been visited since the publication of Stuart and Jensen's paper from 1985. In this connection it should be mentioned that from 1984 and until recently it has been difficult for foreigners to gain permit to work in the Ulugurus.

The Ulugurus were included in biogeographical analyses carried out by Stuart (1981a and 1983) and by Stuart *et al.* (1993).

Appendix 5.2. Footnotes and definitions, Table 5.1.

THESE NOTES HAVE BEEN MOVED IN THIS THE ELECTRONIC VERSION TO BELOW THE TABLE 5.1 WHICH IS A MORE LOGICAL PLACE TO HAVE THEM.

Appendix 5.3. General distributions of the Threatened species, with notes on earlier Uluguru records.

General distribution of *Bathmocercus winifredae*.

An Eastern Arc forest endemic known only from four Tanzanian mountain ranges: the Ulugurus (type locality, discovered 1937, see below), the Ukagurus (discovered 1964 and recorded also on subsequent visits to the area, records are from between 1500 and 1850 m, described as common during a survey in 1978, heard moderately frequently during a survey in 1990), the Udzungwas (discovered 1982 but known only from Mwanihana Forest despite many other areas of the Udzungwas being worked; at Mwanihana, where it has been recorded from 1300 to 1700 m, it is fairly common) and the Rubehos (discovered 1993 when heard on several occasions by J. Fjeldså) (Collar and Stuart 1985, Evans and Anderson 1992 and 1993b, Jensen and Brøgger-Jensen 1992, Moyer 1993, Dinesen *et al.* 1993, Collar *et al.* 1994). All populations are assigned to the nominate race.

There were several earlier records from the Ulugurus, from the northern section as well as the Bunduki and Tchenzema areas (Moreau 1938 and 1946, Williams 1951, Friedmann and Stager 1964, Scharff *et al.* 1982, Stuart and Jensen 1985, and specimens in e.g. Copenhagen, Nairobi and Tring [Collar and Stuart 1985]). Stuart and Jensen (1985) described the species as being fairly common in the montane forest from 1350 to at least 2350 m. However, according to Moreau (1946) it is uncommon below 1650 m.

General distribution of *Apalis chariessa*.

This very beautiful canopy species is - apart from the Ulugurus - only known from Southern Malawi (11 severely threatened montane forest patches, recorded between 500 and 1550 m, total population assessed to be not much above 100 pairs in the late 1980ies), Mount Chipero in Mozambique (collected in 1950 at c. 1500 m, status unknown), the Udzungwa Mountains (discovered in the early 1980ies, recorded in five small and large forests, generally uncommon but locally more common, recorded from 1000 to 1600 m, with a single observation from 2000 m) and - very isolated - the lower Tana River, Kenya (where not recorded since 1960 and possibly extinct though still suspected to occur in some of the few remaining forest patches) (Benson 1950, Britton 1980, Collar and Stuart 1985, Dowsett-Lemaire 1989, Jensen and Brøgger-Jensen 1992, Dinesen *et al.* 1993, Lovett and Moyer in press, Moyer 1993, Collar *et al.* 1994, LAH and JOS pers. obs. from the Udzungwas 1994). Interestingly, *A. chariessa* has never been recorded in the Usambara Mountains.

All earlier Uluguru records of *A. chariessa* are from the Uluguru North F.R. (Stuart and Jensen 1985). A pair was collected in 1938 at 1100 m (Moreau 1940). The next published records are from the 1980ies. Several individuals were seen in mid July 1981 in Kinole Forest from 1250 to 1400 m (Stuart and Jensen 1981). There is one record from the western side in the forest above Morningside, 1500 m (D.C. Moyer pers. comm. to Stuart and Jensen 1985).

General distribution of *Anthreptes rubritorques*.

A middle-altitude Eastern Arc endemic known from the Usambaras (discovered 1905, fairly common between 750 and 1200 m with flocks of up to 60 seen, less common between 1200 and 1500 m and with a single recent record from the foothills), the Ngurus (discovered in the 1940ies, foothills up to 1600m, apparently very uncommon although one report describes the species as common at flowering trees in the foothills), the Ulugurus (discovered in the 1950ies, apparently very uncommon, see below) and the Udzungwas (discovered 1982, very rare, 850-1550 m) (Collar and Stuart 1985, Jensen and Brøgger-Jensen 1992, Dinesen *et al.* 1993, Moyer 1993, Cambridge Tanzania Rainforest Project 1994, Collar *et al.* 1994).

The Uluguru population of *A. rubritorques* is documented only by five specimens, all collected by Andersen at Bagiro (Collar and Stuart 1985, Stuart and Jensen 1985). Two of these specimens were said to have been collected at 900 m and one as high as 1800 m (Britton 1978 and 1981, Collar and Stuart 1985) but Andersen's altitude data are often unreliable (Collar and Stuart 1985, Stuart and Jensen 1985, our Appendix 5.1) and it seems unlikely that he collected the species above 1600 m (Stuart and Jensen 1985).

General distribution of *Malaconotus alius*.

This species - one of the rarest in Africa - is endemic to the submontane and montane forest of the Uluguru Mountains where recorded from 1300 to 2100 m (Collar and Stuart 1985, Stuart and Jensen 1985, Collar *et al.* 1994). *Malaconotus alius* was discovered in 1926 when two specimens were collected at 1830 m at Bagilo on the eastern slopes of the Uluguru North F.R. by Arthur Loveridge's native collector Salimu bin Asmani (Friedmann 1927, Loveridge 1960). The next observation is from 1948 when one bird was seen in forest above Bunduki on the western slopes of the mountains by J.G. Williams (Collar and Stuart 1985). Between 1952 and 1962 at least 13 specimens were collected, one being labelled "Ulugurus" and the remainder coming from Bagilo, 1800 m (Collar and Stuart 1985). Many of the Bagilo specimens were collected by Andersen and his collectors (Appendix 5.1). As indicated in Appendix 5.1, almost all Andersen's specimens (of all species) from the Bagiro area were labelled 1800 m, and we therefore don't know precisely at which altitudes his *M. alius* specimens were collected. In 1981 the species was seen and heard on both sides of Lupanga Mountain (west side: immature at 1600 m, adult nearby at 1650 m plus apparently some extra records of birds only heard), and on the west escarpment of the Lukwangule Plateau at 2100 m (Stuart and Jensen 1981, Scharff *et al.* 1982). Another bird was seen at 1300 m on the eastern side of Lupanga in 1982 (Stuart and Jensen 1985). Several expeditions to the Ulugurus have failed to detect the species (Collar and Stuart 1985): The Cheney expedition searched diligently for the species during their 10 days of collecting above Bunduki in 1964 but failed to find it. They concluded that "It must be a bird of low numerical status and very local in its distribution to have evaded the search made for it" (Friedmann and Stager 1964). Another expedition to the Ulugurus in 1972 also failed to observe it (D.A. Turner pers. comm. 1977 to Collar and Stuart 1985).

General distribution of *Ploceus nicolli*.

This rare Eastern Arc montane forest endemic is known only from three mountain ranges: the Usambaras (discovered 1931), the Ulugurus (discovered 1952) and the Udzungwas (discovered 1981); at all three localities it is elusive and occurs at low densities (Collar and Stuart 1985, Collar *et al.* 1994). In the East Usambaras the species has been seen at 900 m near Amani in the 1930ies but has possibly disappeared from this locality now (Collar and Stuart 1985). Another small population in the East Usambaras was discovered recently at 1250 m on the previously un-surveyed Mount Nilo (Collar *et al.* 1994). From the West Usambaras there are several records from between 1370 and 2200 m (several observations from both below and above 1700 m) (Collar and Stuart 1985). In the Udzungwas the species has been recorded from 1100 to 1700 m on the eastern escarpment, at 1850 and 2150 m in the Ndundulu Mountains (uncommon and not seen below 1850 m despite of a high intensity of general field observations) and from 1400 to 1570 m in the Nyumbanitu Mountains (seen at two localities) (Stuart *et al.* 1987, Jensen and Brøgger-Jensen 1992, Dinesen *et al.* 1993, LAH and JOS pers. obs. from the Nyumbanitu Mountains 1993-94).

The Uluguru population of *P. nicolli* is known from two specimens and one sighting (Collar and Stuart 1985, Stuart and Jensen 1985). One of the specimens (an adult male) was collected by Thorkild Andersen at 1500-1800 m in 1952 (Franzmann 1983) and the other (a female) was taken by G. P. Heinrich at 1600 m "near Morogoro" in 1961 (Ripley and Heinrich 1966). The sighting was of a bird at 1350 m in Kinole Forest in 1981 (Stuart and Jensen 1981). It appears to be a very low density bird in the Ulugurus (Collar and Stuart 1985, Stuart and Jensen 1985).

Appendix 5.4. General distributions of the Near-threatened species, with notes on earlier Uluguru records.

General distribution of *Circaetus fasciolatus*.

A resident raptor of coastal woodlands and forests from Southern Somalia south to Natal and Zululand in South Africa (Britton 1980, Brown *et al.* 1982) but occurs also inland (see below). Its status in the coastal areas has been described as "normally uncommon, at best frequent, but probably commoner than supposed, as hard to locate and see" by Brown *et al.* (1982; covering its entire breeding range) and as "a reasonably common resident in forest (including remnants) throughout the coastal strip" by Britton (1980; covering East Africa). In Tanzania the species occurs inland in e.g. the Usambaras, the Ngurus, the Ulugurus, the Udzungwas and Ruaha N.P. (Britton 1980, Stuart and Jensen 1981, Brown *et al.* 1982, Fuggles-Couchmann 1984a, Stuart and Jensen 1985, Jensen and Brøgger-Jensen 1992). Other inland records include Voi in Kenya (Britton 1980) and Eastern Zimbabwe (Brown *et al.* 1982). *C. fasciolatus* is widespread and in no immediate danger but its habitat is declining (Collar and Stuart 1985).

From the Ulugurus there was only a single previous record (Kimboza Forest, 300 m) (Stuart and Jensen 1981 and 1985).

General distribution of *Anthreptes neglectus*.

Known from several records from the Kenya coast and from several coastal forests in Tanzania and northern Mozambique (Collar and Stuart 1985). Occurs inland in certain Eastern Arc mountains, including the Ulugurus: Fairly common (at least in the foothills) in the East Usambaras where occurring from the foothills up to 1200 m (Britton 1980, Stuart 1983 and 1989, Cambridge Tanzania Rainforest Project 1994). In the Ngurus it is apparently scarce, records are from 1300 to 1500 m (Britton 1980). In the Udzungwas it has been recorded within every 100 m interval from 300 to 1300 m in Mwanihana Forest (Stuart *et al.* 1987, Jensen and Brøgger-Jensen 1992), in unknown densities at 750-1050 m and infrequently at 1400-1500 m in the southern part of the Udzungwa Scarp Forest Reserve (Jensen and Brøgger-Jensen 1992, Moyer 1993), and infrequently between 1350 and 1400 m in the Ndundulu and Nyumbanitu Mountains (Dinesen *et al.* 1993).

In the Ulugurus it is common in the eastern foothill forests (Stuart and Jensen 1985). It has been recorded on the eastern slopes up to 1300 m (Moreau *in* Stuart and Jensen 1985) and possibly 1800 m (Andersen *in* Stuart and Jensen 1985). There is also a record from "Uluguru" (Friedmann and Loveridge 1937). There are no definite records from the drier western slopes (Stuart and Jensen 1985).

General distribution of *Nectarinia loveridgei*.

Known only from the Uluguru Mountains where it is common (Stuart and Jensen 1985, Collar and Stuart 1985). Earlier records are from between 1300 and 2350 m.

Relationship of *N. loveridgei* with other sunbirds.

Several authors have commented on the close relationship of *N. loveridgei* with other members of the *Nectarinia regia* superspecies, especially Moreau's Sunbird *N. moreaui* and Eastern Double-collared Sunbird *N. mediocris* (e.g. Williams 1950, Hall and Moreau 1970, Stuart and van der Willigen 1980, Sibley and Monroe 1990, Dowsett and Dowsett-Lemaire 1993, Evans and Anderson 1993a). During our survey a large number of biometric measurements of *N. loveridgei* were obtained. These will hopefully be compared with similar measurements of *N. moreaui* (e.g. from

the Ukagurus and the Rubehos where mistnetting have been carried out by other fieldworkers) and *N. mediocris* (from earlier extensive fieldwork in the Udzungwas by LAH and JOS) in a separate paper.

Appendix 5.5. Notes from our survey on forest species other than Threatened, Near-threatened and other restricted-range species'

Black Goshawk (Black or Great Sparrowhawk) *Accipiter melanoleucus* (G):

Our record from Bunduki (where it was seen outside forest) is the second published from the Ulugurus. The first was from Bagilo (Stuart and Jensen 1985). In the Usambaras this species is stated to occur widely but in very small numbers, usually near forested areas (Stuart and Jensen 1985) and the same is the case in the Udzungwas (Jensen and Brøgger-Jensen 1992, LAH and JOS). This could also be the case in the Ulugurus.

African Goshawk *A. tachiro* (P, T, G):

Clearly the most common forest hawk in the Ulugurus. Territory calls were heard from many of our camps, typically in the mornings (Table 5.10). Recorded several times in the forest strip at Kigurunyembe. Stuart and Jensen (1985) surprisingly traced only two records from the Ulugurus but assumed that it is widespread. This has now been confirmed. We also saw the species in Singiza village (440 m).

Mountain Buzzard *Buteo oreophilus* (P, G):

Frequently seen or heard soaring over the forest in the Kimhandu, Lanzi and Tchenzema areas. Stuart and Jensen (1985) also report the species to be common.

Crowned Eagle *Stephanoaetus coronatus* (G):

This big monkey- and hyrax-eating eagle (normally easy to detect due to its far-carrying territory calls) was recorded at all three main localities in the Uluguru North and South F.R.s (and also in Kimboza F.R. and at Kigurunyembe), but comparing with other Eastern Arc montane forests visited by JF, LAH and JOS, it is our impression that we recorded it remarkably infrequently during the survey. Stuart and Jensen (1985) reported it to be common in the Kimboza Forest and in the forest of the northern section of the Ulugurus up to 2140 m. There were no earlier published records from the Uluguru South F.R.

Crested Guineafowl *Guttera pucherani* (G):

Recorded in Kimboza F.R on several occasions during the visit by JF and JK and was also seen from the car while passing Kimboza. These are the first confirmed records from the Ulugurus since the late 1930ies, apart from an unidentified guineafowl feather found in 1984 (Stuart and Jensen 1985). The species may suffer from hunting in the Kimboza-Ruvu area (from e.g. local farmers and ruby miners) but no information was collected on the subject.

Buff-spotted Flufftail *Sarothrura elegans*:

Not recorded on this survey.

This species, of which the only records from the Ulugurus are of birds collected by Loveridge and Andersen, was not recorded on this survey. It is most likely overlooked in the Ulugurus (Stuart and Jensen 1985). According to Urban *et al.* (1986) *S. elegans* tolerates a wide variety of habitats but is generally associated with forest or thick bush, favouring forest edge, clearings, second growth and more open types of forest, but also occurring in dense forest. It occupies a broad altitudinal range, from lowland rain forest to bamboo forest at 2600 m (Kenya) and *Juniper/Podocarpus* forest at 3200 m (Ethiopia).

Olive Pigeon *Columba arquatrix* (P, T, G):

This large and beautiful pigeon of the canopy was very common at the localities we visited in the Uluguru North and South F.R.s, as is well illustrated by the plot data (Table 5.9). At all stations it was frequently heard singing or seen flying over in small flocks of typically three to five individuals. The largest flock recorded contained 42 individuals and was seen primo October. Flocks of up to seven individuals were frequently seen gathering in fruiting trees. At Kimhandu, 1520 m, single individuals and small flocks of 3-7 individuals were seen flying from a higher altitude to a lower just before dusk. It is the only species of pigeon we recorded at Kimhandu-5 (2520 m) and on the Lukwangule Plateau.

C. arquatrix was surprisingly common in the Ulugurus compared to densities found in the Udzungwa Mountains 1991-92 by LAH and JOS (six months of fieldwork July-April between 1350 and 2400 m in the Ndundulu and Nyumbanitu Mts. and Kisinga-Rugaro F.R.). The species is known to be rather migratory in other parts of its range (see e.g. Dowsett-Lemaire [1989]), so possibly its abundance in Eastern Arc forests fluctuates from year to year, linked to availability of fruiting trees, but little is known about this. The difference between the Ulugurus and the Udzungwas may also be “permanent”.

Bronze-naped Pigeon *C. delegorguei* (P, T, G):

Heard singing frequently near many stations but it was absolutely not as abundant as *C. arquatrix* at the localities we visited. *C. delegorguei* appears to avoid high altitude forest where *C. arquatrix* was seen frequently (Table 5.4).

Lemon Dove *Aplopelia larvata* (M, P, T, G):

This shy ground haunting pigeon was recorded very frequently only at Lanzi-3 (2110 m) where four individuals were mistnetted and where several individuals were seen escaping from our mistnets and several flushed from the ground. In the other study areas it appeared to be scarce. See also Appendix 5.8.

Tambourine Dove *Turtur tympanistris* (P, G):

We heard the species now and then but nowhere very frequently except in the forest strip at Kigurunyembe where it was common. This contradicts the description given in Stuart and Jensen (1985), saying that the species is fairly common throughout the Uluguru forests, from the foothills up to at least 2100 m. Most of our records at the main localities are from near the Tegetero-1 (1345 m) camp but despite that it has a higher plot data score than *Columba delegorguei* at this station (Table 5.9), it is our clear impression from the general field observations that *C. delegorguei* was the most common of the two also here. *Turtur tympanistris* is probably most common at low and intermediate altitudes.

Livingstone’s Turaco *Tauraco livingstonii* (P, T, G):

Common throughout the Uluguru North and South F.R.s as is well illustrated by our plot and tape recording data (Tables 5.9 and 5.10). The species, who’s far-carrying, harsh voice is one of the typical morning sounds in the forest, is represented on the dawn tape recordings at all stations. Heard in some small forest patches we passed in the open country at 1500-1700 m and is quite common even in small patches of exotic trees in the Mgeta, Nyiandira and Tchenzema areas.

Barred Long-tailed Cuckoo *Cercococcyx montanus* (P, T, G):

The characteristic and far-carrying song of this species was heard only occasionally at Kimhandu and Lanzi. At Tegetero area we heard it quite frequently, even during the nights. It is our impression, however, that it was less common also at Tegetero than what was found during fieldwork in the Udzungwas 1991-92 (unpublished records from the Ndundulus which are forested from 1340 to 2400 m, the species was most common up to c. 1750 m in November-January, LAH and JOS). However, Stuart and Jensen (1985) describe it as abundant in the Ulugurus above 1500 m in the hot season. See also Appendix 5.8.

Yellowbill *Ceuthmochares aereus*⁷:

Not recorded on this survey.

We did not find this species which has been recorded from "East Uluguru" at 400 m, Bunduki, Mkaraji and "Uluguru" up to 1800 m. Stuart and Jensen (1985) reported this species to be uncommon in the Ulugurus, compared to the Usambaras. According to Fry *et al.* (1988) the species usually occurs in secondary forest and gallery forest, occasionally riparian *Acacia*.

Barred Owlet *Glaucidium capense*:

Not recorded on this survey.

The only earlier record of this small owl is from Kibungo Forest (close to or synonymous with Kimboza F.R.). Britton (1980) describes the species as a local and generally uncommon resident in forest and richer woodland, mainly below 1200 m.

Wood Owl *Strix woodfordii* (T, G):

Heard at night from most of our camps.

Unidentified owl (G):

Two independent observations, by two persons, of an unidentified (buffy brown?) big owl were made on 5 October. The bird was seen gliding through the forest near the Kimhandu-2 (1710 m) station. Further visitors should be alert of the possible presence of a *Bubo sp.* in the area. No other owls than *Strix woodfordii* were heard at night time, however. A Finnish ornithologist who has been working around the Bagilo area, reports that he has found a feather from an owl which was not *S. woodfordii* (letter to Neil Burgess). These two findings stress the need for further searches for owls in the Uluguru forests.

Scarce Swift *Schoutedenapus myoptilus* (P, T, G):

Schoutedenapus myoptilus, which had never been recorded in the Uluguru Mountains before, was heard and seen frequently over forest at Kimhandu, Lanzi, Tegetero and Tchenzema. It was scored on plots at Tegetero-2 (1535 m) and Tchenzema 2150 m. The birds foraged over the forest alone, pair wise or in flocks of up to at least five. On several occasions they mixed up with flocks of up to 150 swallows, especially Red-rumped Swallow *Hirundo daurica*, flying in front of a depression. Many were also seen at Kigurunyembe at 600-1000 m near the forest strip, mixing up with Little Swift *Apus affinis* and Black Roughwing Swallow *Psalidoprocne holomelas*. Within the Eastern Arc this species has otherwise only been recorded in the Usambaras, where it was discovered in 1980 (Stuart and Turner 1980) and the Udzungwas where it was discovered 1982 (Stuart *et al.* 1987; heard and seen relatively frequently during fieldwork in forest in the Udzungwas by LAH and JOS 1991-92).

In the Malawian forest-capped mountains *S. myoptilus* is a breeding migrant (settling in October or early November and common until March when they suddenly disappear) which presumably breeds in trees in the montane forests (at least in the north) (Dowsett-Lemaire 1989). We have preferred to regard it a forest species although it has not yet been documented whether it is restricted to forested areas in the Eastern Arc.

Narina Trogon *Apaloderma narina* (M, G):

During this survey recorded only in the Kimboza F.R. where several individuals were seen and a single mistnetted. Stuart and Jensen (1985) reported the species to be common in the eastern foothills. There are a few earlier records of *A. narina* from the Uluguru North and South F.R.s from altitudes at which *A. vittatum* is common (Stuart and Jensen 1985) but in general these two species are altitudinally segregated in the Ulugurus as is the case also in other forests holding both species.

⁷ More recently this taxon has been suggested split in a western and an eastern species. This has implication for the taxon occurring in eastern Tanzania which becomes *C. australis*. And the vernacular name becomes Green Malkoha or Green Yellowbill.

Bar-tailed Trogon *Apaloderma vittatum* (M, P, T, G):

Reported to be found fairly common throughout the montane forests (Stuart and Jensen 1985) and was seen and heard frequently during this survey. Recorded on plots at all stations except Kimhandu-3 (1940 m) and Kimhandu-5 (2520 m). Also seen in Singiza village (440 m) in mango trees near houses.

Crowned Hornbill *Tockus alboterminatus* (G):

No previous surveys in the Ulugurus have recorded *T. alboterminatus* in the submontane and montane forests of the Ulugurus (except an old record from 900 m, probably at the forest edge), and we also failed to do so. The species seems to occur only in Kimboza F.R., where it was seen frequently during this survey (also in village/woodland edge), and in Mvuha F.R. and other dense woodlands in the foothills where we saw it from the car while passing. There is, though, an earlier record from Mgeta (Baker pers. comm. to Stuart and Jensen 1985).

The altitudinal abundance pattern of *T. alboterminatus* recorded in the Ulugurus differs from what LAH and JOS found in the Ndundulu Mountains (forest cover from 1350 to 2400 m, in the Udzungwas) during four and a half months of fieldwork 1991-92: At this locality *T. alboterminatus* was recorded frequently deep inside submontane and montane forest, in the dry season as well as in the hot season and records were made up to 2200 m. It was, however, clearly less common than *Ceratogymna brevis*. At Mwanihana on the eastern scarp of the Udzungwas it has been recorded only up to 700 m (Stuart *et al.* 1987). Probably it cannot be excluded that the abundance of *T. alboterminatus* fluctuates from year to year, following abundance of fruits. Fry *et al.* (1988) characterise *T. alboterminatus* as an arboreal species found in montane, coastal, riparian and secondary forest patches, also extending to some areas of dense woodland; occurs up to 3000 m.

Trumpeter Hornbill *Ceratogymna bucinator* (G):

Seen frequently in Kimboza Forest during this survey. Also Stuart and Jensen (1985) report it to be common only in Kimboza. The only other record from the Ulugurus is from Bagilo (Friedmann and Loveridge 1937, Stuart and Jensen 1985). According to Fry *et al.* (1988) it inhabits interior and edge of montane, riparian and coastal forest, also moist woodlands and mangroves. It may be overlooked in the lower parts of the submontane areas of the Ulugurus.

Silvery-cheeked Hornbill *C. brevis* (P, T, G):

This big and noisy canopy bird was common at all localities and was recorded on plots at seven of 13 stations (up to 36 % of the plots per station). It was not, however, recorded above 2160 m. Seen in small groups of trees outside forest (although not very far from this) in the Bunduki area. There were no earlier published records from the southern section.

White-eared Barbet *Stactolaema leucotis* (G):

Recorded very frequently in Kimboza F.R. during the visit by JF and JK. Also Stuart and Jensen (1985) reported it to be common there. According to Britton (1980) the subspecies *leucogrammicum* occupies highland areas to the south, from the Ulugurus to Mahenge, but as is evident from Table 5.4 there are actually no records from submontane and montane areas of the Ulugurus (Mkaraji is at c. 500 m altitude). According to Fry *et al.* (1988) *S. leucotis* frequents large trees in forest and along streams, usually in hills and mountains (to 2600 m, Arusha area) in the north, to coast south from S Mozambique. A slow and monotone typical tinkerbird/barbet call heard at Lanzi, 1960-2000 m, on 8 October could have been from this species.

Green Barbet *S. olivacea* (P, G):

During this survey we did not record it frequently, except in the lowest part of the Tegetero forest where it was noted frequently in mixed feeding parties during the general field observations, and in the forest strip at Kigurunyembe. Stuart and Jensen (1985) reported it to be most common on the eastern slopes in the northern section of the Ulugurus.

Eastern Green Tinkerbird *Pogoniulus simplex*:

Not recorded on this survey.

Although Stuart and Jensen (1981 and 1985) report it to be common in the Kimboza Forest it was not recorded there during our survey. Occurs up to 900 m in the Usambara Mountains (Stuart and Jensen 1985, Evans and Anderson 1992b), and up to 1500 m in Malawi (Fry *et al.* 1988), leaving a theoretical possibility that it could be found in small numbers in lower parts of the Uluguru North.

Moustached Green Tinkerbird *P. leucomystax* (M, P, T, G):

This species has a penetrating monotypic call which is audible on long distance, and was heard frequently at all localities as illustrated by the plot data (Table 5.9). At Tchenzema it was recorded on no less than 92 % of 25 plots. Everywhere it was, however, hard to get visual observations of this small barbet. Judging from how frequent vocalizations were heard during general field observations and further supported by the plot data, *P. leucomystax* is more common in the Kimhandu area and at Tchenzema than at Lanzi and Tegetero. It could be that breeding activities had reduced the vocal activity at Lanzi and Tegetero, but the difference may also have to do with a difference in the availability of certain fruits.

The Uluguru population of *P. leucomystax* has two different calls/songs. The deepest of these (heard frequently) has never been heard during several months of fieldwork carried out in the Udzungwas by LAH and JOS.

Yellow-rumped Tinkerbird *P. bilineatus* (P, G):

Not recorded at Lanzi and much less common than *P. leucomystax* at Kimhandu and Tegetero. Also Stuart and Jensen (1985) remarked that the species is clearly outnumbered by *P. leucomystax* at intermediate elevations. At Kigurunyembe it was common in the forest strip. In Kimboza Forest it is reported to be "not uncommon" but outnumbered by *P. simplex* (Stuart and Jensen 1985).

Scaly-throated Honeyguide *Indicator variegatus* (G):

Heard on a single occasion during our survey (Tegetero area). Stuart and Jensen (1985) suggest that the species is overlooked in the Ulugurus, and that it probably occurs widely throughout the forest in small numbers.

Eastern Least Honeyguide (Pallid Honeyguide) *I. meliphilus*:

Not recorded on this survey.

Stuart and Jensen (1985) mention a specimen "almost certainly of this species rather than the Kilimanjaro Honeyguide *Indicator narokensis*" collected by Andersen in forest at 900 m. In the Usambara mountains it occurs in small numbers in lowland forest, therefore Stuart and Jensen (1985) suggest that it can also be expected to occur in Kimboza Forest and elsewhere in the foothills.

Olive Woodpecker *Dendropicos griseocephalus* (P, G):

Found near most of our stations but at low densities. Recorded in many of the mixed feeding parties we saw in the Tegetero area.

African Broadbill *Smithornis capensis* (M, P, T, G):

Recorded most frequently at Tegetero with a few observations from near Kimhandu-2 (1710 m). Not recorded at Lanzi. Compared to densities found in the Udzungwas in 1991-92 (LAH and JOS, unpublished records from fieldwork in the Ndundulus above 1350 m, where the species was common up to 1750 m), *S. capensis* was surprisingly uncommon at the localities we visited. The low density is underlined by the few individuals audible on our tape recordings (the voice of this species is one of the most typical "morning sounds" in areas where it is abundant). Also Stuart and Jensen (1985) considered the species to be less common in the Ulugurus than in the Udzungwas (and the Usambaras). The rarity may be a result of the small area in the Ulugurus of premontane forest which is the source habitat for this species. See also Appendix 5.8.

Purple-throated Cuckoo-shrike *Campephaga quiscalina* (G):

A female was seen in Kimboza F.R. It is the rare subspecies *C. q. muenzneri* that occurs in the Ulugurus (Britton 1980).

Grey Cuckoo-shrike *Coracina caesia* (P, G):

In the Kimhandu area the only records were of a few individuals seen and heard on some occasions near the Kimhandu-3 (1940 m) station. It is a silent bird which can be overlooked if not in a feeding party (the most commonly heard voice is a high-pitched, low-volumed short whistle - not what one would expect from a bird of its size) but it must be regarded as uncommon in the Kimhandu area. In the Lanzi area it was seen on some occasions in a wider altitudinal range but also here it appeared to be uncommon. In the Tegetero area it was common below 1600 m, and it was seen in most of the feeding parties studied. See also Appendix 5.7.

Shelley's Greenbul *Andropadus masukuensis* (M, P, T, G):

Recorded very frequently at most stations, being absent only at the high-altitude station Kimhandu-5 (2520 m) as illustrated by the plot and mistnetting data. The second most frequently mistnetted species.

Mountain Greenbul *A. tephrolaemus* (endemic subspecies *neumanni*) (M, P, T, G):

Very common in the Uluguru North and South F.R.s (see mistnetting, plot and tape recording data). The plot data show that at Kimhandu and Lanzi the species is most common above 1700 m altitude. At Lanzi it is common even down to 1700 m. At Kimhandu-5 (2520 m) it is very common in the elfin forest and the only greenbul recorded. Also very common in elfin forest on the Lukwangule Plateau. Morphologically this endemic subspecies is one of the most distinct in the *A. tephrolaemus* complex. The repertoire of calls and song (tape recorded during our survey) differ slightly from the vocalisations we have heard from the subspecies occurring in the Udzungwas (LAH and JOS).

Olive-headed Greenbul *A. olivaceiceps* (M, P, T, G):

Relatively common, being absent only at the highest altitudes. Recorded most frequently in the Tegetero area below 1500 m. See also Appendix 5.8.

Little Greenbul *A. virens* (M, P, G):

Very common in Kimboza FR. Common at Kimhandu-1 and -6 (1520 and 1540 m) (see mistnetting and plot data) which were situated less than 500 m from the lower forest edge. Recorded in *Eucalyptus* forest at Bunduki, in the forest strip at Kigurunyembe (common) and at 1500 m at Morningside. The above-mentioned combined with the fact that the species was not recorded higher than at 1200 m in the Tegetero area, shows that in the Uluguru North and South F.R.s it is the presence/absence of edge habitat rather than of submontane forest that determines its abundance.

Yellow-bellied Greenbul *Chlorocichla flaviventris*:

Not recorded on this survey.

This species, of which the only Uluguru records are of a specimen collected by Loveridge (1933; exact locality unknown) and of a bird collected in Kibungo Forest by Moreau, is either unexpectedly uncommon or greatly overlooked in the Ulugurus (Stuart and Jensen 1985). According to Britton (1980) this is a common species of eastern lowlands, frequenting forest, forest edge, woodland and bush land thicket and secondary scrub habitats, regularly as high as 1700-2100 m in some northern parts of its range. Keith *et al.* (1992) furthermore mention occurrences up to 1700 m in Malawi but also describes it as a species mainly of lowland forest.

Terrestrial Greenbul *Phyllastrephus terrestris* (M):

A single bird was mistnetted in Kimboza Forest during our survey. The only earlier observation from the Ulugurus is of a specimen collected by Loveridge (Loveridge 1933, Stuart and Jensen 1985). Elsewhere in eastern Tanzania this is an uncommon species of lowland forest and thicket (Britton 1980, Stuart and Jensen 1985).

Fischer's Greenbul *P. fischeri* (G):

Several were heard in the forest strip at Kigurunyembe (600-850 m) during the visit by JF and JK. Stuart and Jensen (1985) report this species to be common in both Kibungo and Kimboza Forests. Our records are the first from outside the foothills of this species, which is mainly restricted to lowland forest. The highest altitudinal record listed for the species in Britton (1980) and Keith *et al.* (1992) is 600 m (in the Usambaras).

Grey-olive Greenbul *P. cerviniventris* (M, G):

Two birds were mistnetted at Kigurunyembe where the species was also heard. There were only two earlier records from the Ulugurus (Stuart and Jensen 1985): one of a specimen from "Uluguru" (Friedmann and Loveridge 1937) and one of two birds collected at Morningside by K.M. Howell in 1982 (Stuart and Jensen 1985). According to Stuart and Jensen (1985), this species has only been found in thickets away from the forest in the Ulugurus and the Usambaras. Britton (1980) describes it as local and uncommon in forests and streamside thickets up to 1500 m, with a curiously fragmented distribution.

Placidus Greenbul *P. placidus* (M, P, T, G):

Common in the submontane and montane areas except at the highest altitudes. Monospecific feeding parties of this species were seen in the Uluguru South and North F.R.s.

Yellow-streaked Greenbul *P. flavostriatus* (P, G):

This typical mixed feeding party species was recorded in almost all drongo parties studied at Tegetero and in Kimboza Forest (see Appendix 5.7). The highest altitude in which we noted drongo parties was 1450 m. A few *P. flavostriatus* were seen between 1450 and 1500 m, moving solitarily (few singing birds were heard) or in small parties with e.g. Dark-backed Weaver *Ploceus bicolor*.

There are no previous records of *P. flavostriatus* from the Uluguru South F.R. and we also failed to record it there during this survey. The species probably depends on source habitat in the submontane zone (below 1500 m) although we have recorded it up to 2000 m in the Udzungwas (LAH and JOS pers. obs., from the Ndundulus 1991-92 where the species was uncommon above 1750 m). Stuart and Jensen (1981 and 1985) report it to be common from 300 m in the eastern foothills (probably the Kimboza Forest) up to 1500 m. The earlier record from 1800 m (Table 5.4) is one of Andersen's and may be from a lower altitude.

Tiny Greenbul *P. debilis* (G):

Only one individual was seen during this survey, namely in Kimboza Forest. Stuart and Jensen (1985) describe this species as being common in the eastern foothill forests.

Red-tailed Ant Thrush *Neocossyphus rufus* (M, G):

Two individuals were mistnetted in Kimboza Forest where also visual records were made. Stuart and Jensen (1985) reported the species to be common in the eastern foothill forests. There are earlier records of the species from Morningside, 1500 m (Baker pers. comm. to Stuart and Jensen 1985), and from "Uluguru" (Friedmann and Loveridge 1937). The species is said to follow swarms of driver ants *Dorylus sp.* but this is not confirmed by observations in Kimboza (this survey) and other Tanzanian forests as it is usually seen feeding on insects 5 m above ground or higher, mostly sally-gleaning and perch-gleaning, and often flycatching (JF).

Olive Thrush *Turdus olivaceus*⁸ (M, P, T, G):

It is our clear impression that this species is more common in the Ulugurus than in the Udzungwas (LAH and JOS). The mistnetting catch rates are quite similar to those of the Orange Thrush *Zoothera gurneyi* but *T. (olivaceus) abyssinicus* was seen and heard much more frequently than *Z. gurneyi* (see plot data).

Orange Thrush *Zoothera gurneyi* (M, P, T, G):

According to Stuart and Jensen (1985) the species avoids the high altitude forest in the Usambaras and they speculate whether the same might be the case in the Ulugurus. The results of the present survey show that it is common throughout the forests, even at high altitudes. There were no earlier published records from the Uluguru South F.R. (Stuart and Jensen 1985). See also Appendix 5.8.

Starred Robin (White-starred Robin) *Pogonocichla stellata* (M, P, T, G):

Common at Kimhandu, Lanzi, Tegetero and Tchenzema during our survey, occurring along the entire gradient, as illustrated by plot, mistnetting (third-most frequently mistnetted species) and tape recording data. From the general field observations it was our impression that the species was seen more rarely around Tegetero-1 (1345 m) (the lowest of our stations) but this is not supported by the mistnetting or the plot data. We recorded the species also in tiny patches of wattle (*Acacia*) and bushes below the forest, e.g. in the Tchenzema area at c. 1700 m where several individuals were seen. See also Appendix 5.8.

Olive-flanked Robin *Cossypha anomala* (M, P, T, G):

Common above 1900 m (at Lanzi also down to 1700 m) and a characteristic bird of higher altitudes (see mistnetting and plot data). Tame and on several occasions seen close to tents or near mistnets following human activities (putting up mistnets or establishing a new camp) that expose the bare ground under the leaf litter. Heard in some very small forest patches we passed in the open country (less than 500 m from "the main forest") at 1500-1700 m altitude.

Red-capped Robin *C. natalensis* (M, G):

Common in Kimboza F.R. where mistnetted in good numbers during the visit by JF and JK (seven of the nineteen birds ringed). Also recorded frequently in the forest strip at Kigurunyembe where four individuals were mistnetted (Table 5.12). Stuart and Jensen (1985) describe the species as very common in the eastern foothills. There are also earlier records from "Uluguru" and Bagilo (Friedmann and Loveridge 1937) and from Bagilo and "Uluguru", 1500-1800 m (Andersen *in* Stuart and Jensen), showing that the species occurs also at intermediate elevations. It was not recorded at Tegetero during our survey, supporting Stuart and Jensen's (1985) assumption that it is much less common at intermediate elevations than in the lowland forests.

Evergreen Forest Warbler *Bradypterus mariae* (M, P, T, G):

Common at all altitudes in the Uluguru North and South F.R.s (e.g. Table 5.9). At high altitudes, e.g. at Kimhandu-5 (2520 m) and at the Lukwangule Plateau, it occurs sympatrically with Cinnamon Bracken Warbler *B. cinnamomeus* (for the latter, see Appendix 5.6). Heard in several very small forest patches passed in the open country (less than 500 m from "the main forest") at 1500-1700 m altitude. Some of the birds recorded at Bunduki were observed in *Eucalyptus* forest (in bracken patches). At Tchenzema the species was seen at several occasions in small thickets around the shambas and a single bird was even seen in weeds in a maize field. See also Appendix 5.8.

Kretschmer's Longbill *Macrosphenus kretschmeri* (G):

The only records made during this survey are from Kimboza Forest where several individuals were heard. Apart from the eastern foothill forests earlier records are from Kinole Forest, 1100 m (Moreau *in* Stuart and Jensen 1985), the

⁸ Recently this taxon has shown to be a composite of a number of taxa. The taxon occurring in highland forest in e.g. the Ulugurus are supposed to be *T. abyssinicus* (Mountain Thrush).

northern slopes of Lupanga at 1000 m (Stuart *in* Stuart and Jensen 1985) and Bagilo, 1800 m (Andersen *in* Stuart and Jensen 1985). According to Stuart and Jensen (1985) *M. kretschmeri* appears to be considerably less common in the Ulugurus than in the Usambaras and the Udzungwas. Britton (1980) describes the species as wide-ranging but generally uncommon in forest and fringing thickets, virtually endemic to E Tanzania.

Brown (Woodland) Warbler *Phylloscopus umbrovirens* (endemic subspecies *fugglescouchmani*) (M, P, T, G):

Phylloscopus umbrovirens has its southernmost population in the Ulugurus, the nearest population to the north being in northern Tanzania more than 350 km away. We recorded it frequently around our Kimhandu-5 (2520 m) camp in the elfin forest where it is clearly one of the character species as illustrated by the mistnetting and plot data. It is also common in the Lanzi area above 2200 m and on the Lukwangule Plateau above Tchenzema. It is altitudinally segregated above its close relative *P. ruficapillus* with a contact zone at c. 2200 m. We did not record *P. umbrovirens* in the Uluguru North F.R., doubtless only because we did not survey the uppermost parts there. The earlier record from 900 m is of a specimen collected by Andersen (Stuart and Jensen 1985).

Yellow-throated (Woodland) Warbler *P. ruficapillus* (M, P, T, G):

Recorded frequently at all three main localities but never above 2160 m. See above under *P. umbrovirens*.

Bar-throated Apalis *Apalis thoracica* (endemic subspecies *uluguru*) (M, P, T, G):

Very common at all three main localities (see mistnetting, plot and tape recording data). Generally uncommon in the lower part of the forest (e.g. the area around the Tegetero-1 1345 m) but becomes one of the most characteristic species at higher altitudes. Often watching curiously at 1-2 m distance and must be considered to be more tame in the Ulugurus than in e.g. the Udzungwas (where JF, LAH, JK and JOS have experience with it).

Black-headed Apalis *A. melanocephala* (P, G):

This species was recorded only in the Uluguru North F.R. where it was seen in almost all mixed feeding parties encountered. There are no earlier records from the Uluguru South F.R. and it must be considered to be absent or occurring at only very low densities in that section which does not offer the right conditions - submontane and montane populations of *A. melanocephala* are normally confined to altitudes below 1700 m, primarily the submontane belt where it is most frequently recorded in mixed feeding drongo parties (such parties are lacking in the Uluguru South F.R.).

Green-backed Camaroptera (Bleating Bush Warbler) *Camaroptera brachyura* (P, T, G):

Recorded on several occasions in Kimboza F.R. during the visit by JF and JK. At Kigurunyembe it was common in the forest strip and also in the park around Teachers College, one was mistnetted. Heard often in the disturbed shrubby forest near the lower edge at Kimhandu which is reflected in the plot data from Kimhandu-1 and -6 (1520 and 1540 m). At Tegetero we recorded it only by the standard tape recordings at Tegetero-1 (1345 m).

Dusky Flycatcher *Muscicapa adusta* (M, P, G):

Generally uncommon but was seen occasionally at most localities. Usually seen sitting on a branch in the outermost trees along forest glades or in trees along rivers.

Ashy Flycatcher *M. caerulescens* (G):

The single record from this survey was made in surrounding cultivation in the Ukwama area. Stuart and Jensen (1985) report the species to be common in the eastern foothill forests. At higher elevations in the Ulugurus it is a species of plantations and other wooded areas rather than forest (Stuart and Jensen 1985). Britton (1980) describes the species as

wide-ranging up to 1800 m, in forest edges and glades, riparian forest strips and richer woodland, where it is seldom common.

Forest Batis (Short-tailed Batis) *Batis mixta*⁹ (M, P, T, G):

Common at most stations (see plot and mistnetting data). It was, however, not recorded at the highest altitudes.

Black-throated Wattle-eye *Platysteira peltata* (G):

A few birds were heard in the forest strip at Kigurunyembe. Earlier records are from Morningside, 1200 m (Stuart and Jensen 1985), "Uluguru" (Friedmann and Loveridge 1937) and Bagilo (Andersen *in* Stuart and Jensen 1985). Britton (1980) describes the species as being widespread but generally uncommon in forest patches, forest edges, bush land thickets and gardens up to 3000 m.

Little Yellow Flycatcher *Erythrocercus holochlorus* (G):

A few individuals were seen in Kimboza Forest during our survey. Stuart and Jensen (1985) report it to be common in the eastern foothill forests.

White-tailed Crested Flycatcher *Trochocercus albonotatus* (M, P, T, G):

This small fan-tail flycatcher, usually very vocal and active, is very common in the Uluguru montane forests (see, e.g. plot data). It regularly forages in the understorey down to a level of about two-three feet and is therefore mistnetted at most of the stations. However, the best estimate of its abundance clearly comes from the plot data. See also Appendix 5.8.

Blue-mantled Flycatcher (Crested Flycatcher) *T. cyanomelas* (M, G):

Two birds were mistnetted in Kimboza Forest where it was also seen frequently. Fairly common in the forest strip at Kigurunyembe where one was mistnetted (Table 5.12). Stuart and Jensen (1985) report it to be common in the eastern foothill forests at 300 m. Apart from the foothills there are earlier records also from Bunduki, 1500-1700 m, Mkaraji, "Uluguru", 900 m, and "Uluguru" (Stuart and Jensen 1985).

African Paradise Flycatcher *Terpsiphone viridis* (P, T, G):

As illustrated by the plot data the density was highest at the two lowest Tegetero stations (1345 and 1535 m). In this area it was a frequent member of mixed feeding parties. Relatively common at the lowest altitudes in the Kimhandu and Lanzi areas. One individual mistnetted in the forest strip at Kigurunyembe at 700 m. *T. viridis* is not restricted to forest habitats and was seen in mango trees near small villages on 30 October on our walk from Ukwama village to Kolero village. See also Appendix 5.8.

Pale-breasted Illadopsis *Illadopsis rufipennis*¹⁰ (M, G):

Two birds were mistnetted in Kimboza Forest where the species was also heard. Stuart and Jensen (1985) describe the species as being common in Kimboza. It is interesting that this species has not been recorded above 900 m in the Ulugurus. In the Udzungwas the species can be found up to 1900 m although it is uncommon above 1700 m (Jensen and Brøgger-Jensen 1992, LAH and JOS) and in the Usambaras it occurs up to 1200 m.

⁹ Recently this taxon has shown to be a composite (Jon Fjeldså and Rauri Bowie, in prep.)

¹⁰ Recent field studies (confirmed by a preliminary molecular test by Rauri Bowie), has shown that this taxon also is a composite (Louis A. Hansen *et al.* in prep.)

African Hill Babbler *Alcippe abyssinica* (M, P, T, G):

Quite common locally, e.g. at the Lanzi-3 (2110 m) station and at Tchenzema. At Tegetero and partly Kimhandu it was not recorded frequently and it is surprising that we did not record it above 2000 m at Kimhandu. There may be local variation in its abundance but it is our impression that it is less common in the Ulugurus than what was found during five months of fieldwork in the Udzungwas 1991-92 (LAH and JOS). According to Stuart and Jensen (1985) it is generally fairly common and tends to be most numerous at the higher elevations of the southern section occurring up to at least 2500 m. The species was seen in small forest patches near Tchenzema at c. 1700 m.

Olive Sunbird *Nectarinia olivacea* (M, P, T, G):

At the localities visited during this survey it was recorded frequently only in the lowest part of the Tegetero area (21 mistnetted, Table 5.6), in Kimboza Forest (one mistnetted, Table 5.11) and in the forest strip at Kigurunyembe (one mistnetted, Table 5.12). At Tegetero-1 (1345 m) this species was actually the most frequently mistnetted bird (88 % of all individuals ringed) and exceeded *N. loveridgei* in numbers. In the Uluguru South F.R. it was only common in some areas near the lower forest edge (three mistnetted at Kimhandu-1, Table 5.6). Seen also far from forest in well-wooded cultivated land when we moved to and from the forests (e.g. several were heard while moving by car from the lowlands to the Tegetero area). Seen in bushy land in the Bunduki area at c. 1300 m.

Yellow White-eye *Zosterops senegalensis stierlingi* and *Z. s. andersoni* (M, P, G):

Relatively common at all three main localities as illustrated by the plot data. Stuart and Jensen (1985) report it to be common in the montane forest and much less common in the lowland forests. Birds with characters as *stierlingi* were seen in small forest patches near Tchenzema mission at c. 1700 m.

The birds seen in the mountains during this survey showed the characteristics of the form *Z. s. stierlingi*. Moreau (1957) noted the same. He furthermore noted that the birds seen in the lowland forest showed the characteristics of the lowland form *Z. s. anderssoni*. White-eyes were not seen in the Kimboza during our survey, unfortunately. Further research is necessary to clarify the taxonomy of the white-eye complex. *Z. s. stierlingi* may prove to be a paraspecies in the group of montane white-eyes (*Z. poliogaster sensu lato*) found only in the montane forests, and replaced by *Z. senegalensis (anderssoni)* in the intervening lowlands.

Green-headed Oriole *Oriolus chlorocephalus* (P, G):

This very beautiful oriole was recorded on several occasions in the lower parts of the Tegetero area in the Uluguru North F.R. and in Kimboza Forest. Our record from Tchenzema on the Lukwangule Plateau, where a single bird was seen and heard, is the first published from the Uluguru South. Britton (1980) gives the maximum altitude for this species as 1800 m (probably based on an Andersen record from the Ulugurus) and our record from 2500 m is therefore from an unusually high altitude.

Fülleborn's Black Boubou *Laniarius fuelleborni* (M, P, T, G):

Relatively common throughout the Uluguru North and South F.R.s and one of the characteristic birds of higher altitudes (see plot data). The highest density was recorded at Tchenzema. Heard in some small forest patches and scrubs passed in open country (up to 500 m from "the main forest") at 1500-1700 m and in forest patches on the Lukwangule Plateau.

Black-fronted Bush Shrike *Telophorus nigrifrons* (P, T, G):

Very common in the Tegetero area where it was seen in almost all mixed species parties encountered and outside mixed species parties too. The species was surprisingly uncommon in the Kimhandu and Lanzi areas (apparently more common at Lanzi than at Kimhandu). Stuart and Jensen (1985) mention records from Kimboza and Kibungo Forests in June and suggest that a part of the population moves down to this locality in the cold season. See also Appendix 5.8.

Four-coloured Bush Shrike *Telophorus quadricolor*:

Not recorded on this survey.

Earlier Uluguru records are from "the Uluguru Mountains" and "the Ulugurus" (Loveridge 1933, Britton 1980, Swynnerton *in* Stuart and Jensen 1985). The taxon is thinly distributed in forest undergrowth and thicket throughout the coastal lowlands, occurring also inland at some localities (Britton 1980).

White-throated Nicator *Nicator gularis* (G):

Recorded by JF and JK in Kimboza F.R., at Bunduki and at Kigurunyembe (a few territories). The only earlier records from the Ulugurus are from Kibungo Forest (Moreau *in* Stuart and Jensen 1985), the northern slopes of Lupanga at 1000 m (Stuart and Jensen 1985), Nyingwa (Friedmann 1928) and "Uluguru" (Swynnerton *in* Stuart and Jensen 1985). The species apparently occurs at only low densities in the Ulugurus. Concerning its general distribution Britton (1980) mention that it is not restricted to forest but also occurs in bush land and woodland thicket.

Square-tailed Drongo *Dicrurus ludwigii* (P, T, G):

Common in the Uluguru North F.R. below 1450 m and in the Kimboza F.R. At these two localities it was invariably seen in the mixed feeding drongo parties which were a prominent phenomenon at these two localities (see Appendix 5.7). In the forest strip at Kigurunyembe it was fairly common but on territories and not seen in connection with mixed feeding parties. In the Uluguru South F.R. it was recorded only on a single occasion (near the Kimhandu-6 [1540 m] station; a pair was seen and heard on a single occasion; there were no signs of feeding party activities when the birds were seen). The almost complete absence of *D. ludwigii* from the southern section should probably be explained by the general absence of submontane habitats in this area.

Waller's (Red-winged Starling) *Onychognathus walleri* (P, T, G):

This canopy species was common at all three main localities. Plot data supports the impression from the general field observations, that it was most common around the Lanzi-3 (2110 m) station.

Black-breasted Glossy Starling *Lamprotornis corruscus*:

Not recorded on this survey.

The only records of this species from the Ulugurus are of a few birds seen in Kimboza F.R. in November 1984 (Stuart and Jensen 1985). Generally a common and adaptable bird of forested and formerly forested areas up to at least 1400 m (Britton 1980).

Dark-backed Weaver *Ploceus bicolor* (P, G):

Clearly one of the core species of the mixed feeding drongo parties in the submontane areas at Tegetero and in the lowland Kimboza Forest (see Appendix 5.7). Several pairs were seen in the forest strip at Kigurunyembe. We suppose that the species is (at least almost completely) absent from the Uluguru South F.R. because of the lack of submontane source habitat here and because mixed feeding drongo parties are (at least almost completely) missing here. Stuart and Jensen (1985) report it to be common from 300 m in the eastern foothills up to at least 1400 m on the eastern slopes.

Red-faced Crimsonwing *Cryptospiza reichenovii* (M, P, T, G):

Very common at all stations as shown by the mistnetting data (this understorey species is extremely skulking and quiet and it is really necessary to mistnet to estimate its density).

Abyssinian Crimsonwing *Cryptospiza salvadorii* (G):

Single individuals were seen at Ukwama (1430 m, outside forest) and Tchenzema (1600 m, outside forest). These records are the first from the Ulugurus since 1922 at which time a single female was collected near Mbeta (probably

=Mgeta) and later identified to species (Friedmann and Loveridge 1937)¹¹. Male and female have a similar plumage in this species which in its appearance is quite similar to the female of *C. reichenovii*. However, at both localities (Ukwama, Tchenzema) the birds were seen under good conditions, the Tchenzema bird being observed for 5 minutes at only 10 m distance.

Lesser Seed-cracker *Pyrenestes minor* (G): During this survey the species was only recorded in the Kimboza Forest, where it was heard only a few times. There are several earlier records from the foothills up to 900 m, where it is an uncommon species of undergrowth (Stuart and Jensen 1985). There is also a specimen from Bagilo (Friedmann and Loveridge 1937). Generally a scarce species of undergrowth and secondary scrub of the forest edge, streamside thicket and nearby cultivation in Eastern Tanzania (Britton 1980). The species reaches its northwestern limit in the Uluguru (Britton 1980, Stuart and Jensen 1985)

Peter's Twinspot *Hypargos niveoguttatus* (G):

On this survey only recorded in the forest strip at Kigurunyembe where it was seen and one was mistnetted, and outside forest at Singiza Mission, 440 m. According to Stuart and Jensen (1985) it is common in the eastern foothill forests with a single record from Morningside, 1200 m, from the undergrowth of a plantation, probably not being a forest species at intermediate elevations. According to Britton (1980) the race *H. n. macrospilotus* is a widespread and reasonably common resident frequenting forest undergrowth, moist bush land and woodland thicket, thick herbage by water and dense secondary scrub, ranging throughout most of Tanzania.

Green Twinspot (Green-backed Twinspot) *Mandingoa nitidula* (M, G):

A single individual was mistnetted in Kimboza Forest. This is the first record from that locality. Earlier Uluguru records are from Bagilo (Friedmann 1928), Morningside, 1200 m (Moyer and Baker, pers. comm. to Stuart and Jensen 1985) and "Uluguru," 1200-1500 m (Andersen in Stuart and Jensen 1985). *M. nitidula* is very difficult to detect except with mistnetting, and it may be not uncommon in the ground-water forests along the base of the mountains.

Oriole Finch *Linurgus olivaceus* (M, P, G):

Seen now and then at higher altitudes during the survey. Appeared to occur at low densities. Mistnetted at Kimhandu-3 (1940 m) and Lanzi-3 (2110 m) and recorded on plots at Kimhandu-5 (2520 m) and Lanzi-2 (1920 m). Stuart and Jensen (1985) describe the species as being generally uncommon in the Uluguru, although locally numerous where there is an abundance of seeding plants.

Appendix 5.6. Observations of non-forest bird species from our survey.

The records of "non-forest bird species" (made inside and outside forest) from our survey are listed below. Only little emphasis was laid on "birding" outside forest. Earlier records are not mentioned below unless we have found it relevant, we refer to Stuart and Jensen (1985). We follow Stuart and Jensen's practice by including only species which have been observed above 900 m in the Uluguru and have not included observations from Morogoro Town¹². A few species recorded in Kimboza F.R. but not known from above 900 m are included, however. For several of the species there were no earlier records published specifically from the Uluguru. Very common and

¹¹ Stuart and Jensen (1985) suggested that the specimen described by Friedmann and Loveridge could be a misidentified Red-faced Crimson-wing *C. reichenovii*, possibly an immature bird, since the Uluguru are well outside the known range of *C. salvadorii* (the nearest known locality being Kilimanjaro 400 km to the north) and since no other ornithologists had recorded the species in the Uluguru. However, they must have overlooked Friedmann and Loveridge's citation from a paper by Shelley: "... in its most southern range the species has been met with by Dr. Stuhlmann at Uluguru." Furthermore Friedmann and Loveridge actually remarked that "This single specimen is obviously *Cryptospiza salvadorii* and not *C. reichenowi*". Britton (1980) did not mention *C. salvadorii* from the Uluguru, neither did Hall and Moreau (1970). Our records confirm that Friedmann and Loveridge were right. Friedmann and Loveridge (1937) remarked that their specimen of *C. salvadorii* did not fit any known races. They designated the bird as "subsp. nov.?" and left the absolute determination until more specimens were available. Britton (1980) described the species as being a common resident (our remark: in its range to the north) of the undergrowth of highland forest and bamboo at 1500-3000 m, often in edge and secondary growth areas. It is necessary with further fieldwork (and collection of a few specimens) to determine its taxonomical status and habitat preference in the Uluguru (click on the footnote number to return to text).

¹² Records of species seen in Morogoro Town or only below 900 m are available from the authors (click on the footnote number to return to text).

widespread species may have been “ignored” by earlier fieldworkers to some extent. For other species the lack of records may best be explained by a shortage of fieldwork.

Bold: Species seen inside forest during our survey and which are prominent members of the forest community on at least some of the localities mentioned. **Single underlined (web edition species in maroon):** Other species seen inside forest during our survey (excluding most species seen over the forest except for a few swift and raptor species).

Hamerkop *Scopus umbretta*: Singiza 440 m, Ukwama 1430 m, Lanzi 900 m, Bunduki c. 1300 m, Kigurunyembe 700 m (where seen several times inside the forest along a stream). African Black Duck *Anas sparsa*: Seen swimming in the Mgeta Stream above Lanzi (1860 m). Earlier Uluguru records are from 600-1200 m. Honey Buzzard *Pernis apivoris*: Singiza 440 m, Ukwama 1400 m. First published record from the Ulugurus of this Palearctic migrant. Bat Hawk *Machaeiramphus alcinus*: A single individual was seen in Kimboza Forest at 300 m. First published record from the Ulugurus. Palm-nut Vulture *Gypohierax angolensis*: Kimboza 300 m. Earlier records are from the “the foothills of the Ulugurus” (Britton 1980) and from Kimboza Forest (Stuart and Jensen 1985). African Harrier Hawk (*Gymnogone*) *Polyboroides typus*: Kimhandu 1430 and 2030 m, Lanzi 2030-2100 m, Tegetero 1300-1320 m. Seen hunting well inside forest at all these three localities. Also seen far from forest near Singiza village at 440 m and close to forest in Ukwama village at 1430 m. Earlier records are from c. 300 m (eastern foothill forests) and 2140 m (Lupanga Peak). Gabar Goshawk *Micronisus gabar*: Tchenzema 1700 m where it nested in a big *Ficus* tree. First published record from the Ulugurus. Little Sparrowhawk *Accipiter minullus*: One individual was seen inside forest at Lanzi, 2000 m. Earlier records are from between 300 and 1200 m. In Tanzania generally a species of woodland but occurs at low densities in many forests. Common Buzzard *Buteo buteo* (Steppe Buzzard *Buteo (b.) vulpinus*): Ukwama 1400-1450, Lanzi 2030 m, Tchenzema 1700 m. Palearctic migrant. Steppe Eagle *Aquila nipalensis*: Lanzi 1680 m. First published record from the Ulugurus. Wahlberg's Eagle *A. wahlbergi*: Lanzi 900 m, Kimboza 300 m. First published record from the Ulugurus. African Hawk Eagle *Hieraetus spilogaster*: One was seen at 1400 m in the Kimhandu area. Long-crested Eagle *Lophaeetus occipitalis*: Kimhandu 1500-1990 m. Occasionally seen soaring over the forest and open country side in the Kimhandu area. May breed in the forest edges. Lesser Kestrel *Falco naumanni*: Bunduki 1000 m. First published record from the Ulugurus. Lanner Falcon *F. biarmicus*: Ukwama 1500 m. First published record of this huge falcon from the Ulugurus. Peregrine Falcon *F. peregrinus*: Bunduki 1700 m (breeding record). Red-eyed Dove *Streptopelia semitorquata*: Kigurunyembe at 700-1000 m in woodland and at 650-850 m in the ecotone between forest and adjacent woodland. Emerald-spotted Wood Dove *Turtur chalcospilos*: Kimboza 300 m. Blue-spotted Wood Dove *T. afer*: Tchenzema 1600 m. Green Pigeon *Treron calva*: Seen frequently in Kimboza Forest during the visit by JF and JK. Near Bunduki a few individuals were seen and in the foothills below Bunduki large flocks were seen in the miombo fire-climax zone. At Kigurunyembe it was heard at c. 700 m in the forest strip and seen in woodland just outside the strip. There were no earlier published records from the Ulugurus apart from an observation mentioned in Friedmann and Stager (1964) without any information on altitude and locality (Stuart and Jensen 1985). Stuart and Jensen (1985) did, however, expect the species to be present. It inhabits a broad range of habitats (Britton 1980, Urban *et al.* 1986), being mostly confined to edges and clearings when occurring in forest. Fischer's Lovebird *Agapornis fischeri*: One pair (breeding?) was seen at 600 m near buildings at Teachers College, Kigurunyembe, on 7 November and again 7-8 December. Britton (1980) did not mention any records from the Ulugurus. This species is treated as Near-threatened in Collar *et al.* (1994). Red-chested Cuckoo *Cuculus solitarius*: Singiza 440 m, Ukwama 1400-1430 m (common), Kimhandu 1520-1600 m, Lanzi 900 m (fairly common). A few individuals were recorded inside forest at Kimhandu though never very far from the forest border. Klaas's Cuckoo *Chrysococcyx klaas*: A few individuals were heard singing inside the forest at Kimhandu 1550-1940 m, Tegetero 1345-1600 m and Kimboza 300 m. At Kigurunyembe it occurred in the forest edge at 650-850 m and in woodland outside the forest strip. Also recorded at Bunduki 1300 m and near Singiza village at 440 m. There were several earlier records from forest and non-forest habitats in the Ulugurus, from the foothills up to 1800 m. Britton (1980) describes the species as widespread and reasonably common in woodland, forest edges and clearings, thickets and gardens from sea-level up to 3000 m. White-browed Coucal *Centropus superciliosus*: Ukwama 1430-1500 m, Lanzi 900 m, Kimboza 300 m (common), Kigurunyembe in woodland outside the forest strip (common). Bat-like Spinetail (Böhm's Spinetail) *Neafrapus boehmi*: Kimboza 300 m. Stuart and Jensen (1985) report this species to be fairly common in Kimboza Forest. According to Fry *et al.* (1988) this species inhabits airspace around trees in a variety of woodlands and also clearings and edges of evergreen lowland forest. African Palm Swift *Cypsiurus parvus*: Kimhandu 1940 m (common), Kimboza 300 m (very common). Mottled Swift *Apus aequatorialis*: Ukwama 1430-1520 m, Kimhandu 2145 m. One earlier published record from the Ulugurus (from Lupanga Peak). According to the map of distribution shown in Fry *et al.* (1988) this species (which occurs in rocky crags in highlands up to 3000 m) is in Tanzania restricted to highlands in the northern and south-western part of the country with a few scattered records elsewhere. [Nyanza Swift *A. niansae*: Kimhandu 1600 m, Lanzi 2130 m. First published records from the Ulugurus. According to Britton (1980) and Fry *et al.* (1988) this partially migratory swift has its southernmost population in Arusha N.P. in northern Tanzania. Identification of swifts is sometimes tricky, so it is best to regard our two single observations with some caution, pending further fieldwork in the Ulugurus]. African Black Swift *A. barbatus*: Kimhandu 1600 m (common), Lanzi 1900-2570 m, Tegetero 1345 m. First published records from the Ulugurus. According to Fry *et al.* (1988) there are only few published records from E and S Tanzania. Little Swift *A. affinis*: Kigurunyembe 700-1000 m, Singiza 440 m (very common and breeding). First published records from the Ulugurus of this widespread species. African White-rumped Swift *A. caffer*: Lanzi 900 m, Tegetero 1660 m. Speckled Mousebird *Colius striatus*: Morningside below 1500 m (common), Bunduki below 1500 m (common). European Bee-eater *Merops apiaster*: Lanzi 1920-2200 m where flocks of what we believe were migrating birds were frequently recorded, sometimes only heard soaring above the forest. Also at Kigurunyembe where seen above woodland at 700-1000 m. First published records from the Ulugurus. Broad-billed Roller *Eurystomus glaucurus*: Recorded fairly frequently in Kimboza Forest.

Also seen at 600 m in the park area at Teachers College near Kigurunyembe. First published record from the Ulugurus. Britton (1980) describes the species as being locally common in woodland, forest edges and clearings, and open country with tall trees near water, usually below 2000 m. It is an intra-African migrant and is probably most abundant in the hot season. Red-billed Wood Hoopoe (Green Wood-Hoopoe) *Phoeniculus purpureus*: A single bird was seen in the lowest forest part in the Kimhandu area at 1480 m. First published Uluguru record from outside Kimboza Forest where seen several times during the visit by JF and JK and where also seen by Stuart and Jensen (1985). According to Fry *et al.* (1988), *P. purpureus* is "absent from arid zones and forest". However, during fieldwork in the Udzungwas 1991-92 (Ndundulu Forest, 1350-2400 m) it was found deep inside forest at 1500-1800 m, although in low numbers (LAH and JOS). In Mwanihana Forest on the eastern scarp of the Udzungwas it occurs from 1200 to 1800 m (Stuart *et al.* 1987). Further fieldwork in the Uluguru montane forests might reveal a similar occurrence inside forest here. According to N. Burgess (*in litt.*) it also occurs in coastal forests. Britton (1980) describes it as a widespread resident and wanderer in woodland and other habitats with tall trees up to 2800 m. Spot-flanked Barbet *Tricholaema lachrymosa*: Bunduki 1300 m. First published record from the Ulugurus. Greater Honeyguide *Indicator indicator*: Kimboza 300 m. First published record from the Ulugurus. Black Saw-wing *Psalidoprocne holomelas*: Ukwama 1400-1600 m, Kimhandu 1520-2520 m (common), Lanzi 1840-2030 m (common), Tegetero 1300 and 1680 m (common), Tchenzema 2100 m, Kigurunyembe 650-850 m (common). Heard often above the forest. Sometimes forages low over the canopy and at a few occasions even below the canopy along streams. Seen frequently near the forest edges. Red-rumped Swallow *Hirundo daurica*: Ukwama 1400-1520 m, Kimhandu 1520-2520 m (common to very common), Lanzi 1680-2570 m (common), Tegetero 1345-1770 m (common), Tchenzema 1700 m. In many places seen near the forest edge. Flocks of up to 150 individuals were seen at Kimhandu-5 (2520 m). African Rock Martin *H. fuligula*: Singiza 440 m, Ukwama 1400-1430 m (common), Lanzi 1680 m (common). Wire-tailed Swallow *H. smithii*: Singiza 440 m (very common, nesting), Kimboza 300 m. European Swallow *H. rustica*: Ukwama 1400 m (common), Lanzi 2500-2570 m (common to very common). Angola Swallow *H. angolensis*: Lanzi village only seen once or twice. Grey Wagtail *Motacilla cinerea*: Lanzi 1850-1890 m where 1-2 birds were seen on more occasions in the Mgeta stream, sometimes where the river passed a meadow but also sometimes inside forest. First published record from the Ulugurus of this Palearctic migrant. Mountain Wagtail *M. clara*: Ukwama 1430 m, Kimhandu 1520-1710 m, Lanzi 1900 m, Tegetero 1480-1720 m, Bunduki 1500 m, Kigurunyembe 700 m (heard once). Seen in mountain streams both inside and outside forested areas. African Pied Wagtail *M. aguimp*: Singiza 440 m. Common (Yellow-vented) Bulbul *Pycnonotus barbatus*: Singiza 440 m, Ukwama 1430-1540 m (very common), Kimhandu 1520-1550 m, Lanzi 900 m (very common), Tchenzema 1700 m, Kimboza 300 m (common), Bunduki up to 1500 m (common), Kigurunyembe 600-850 m. Recorded most frequently outside forest but was also seen and heard in edge habitats, sometimes extending a little into forest. At Kigurunyembe it was fairly common even inside the forest. Cape Robin *Cossypha caffra*: Ukwama 1400-1600 m (common), Tchenzema 1500-1700 m, the Lukwangule Plateau 2500 m, Morningside 1500 m. Heuglin's Robin (White-browed Robin-Chat) *C. heuglini*: Lanzi 900 m (common), Morningside 1500 m (common) and at Mgeta and Tegetero. **Eastern Bearded Scrub Robin *Cercotrichas quadrigata***: A character bird in the forest strip at Kigurunyembe up to at least 850 m, one was mistnetted at this locality (Table 5.12). According to Britton (1980) this species is a common resident of bush land and woodland thickets, forest undergrowth and gardens from sea-level to 1000 m, exceptionally as high as 1800 m in the North Pare Mountains. Stuart and Jensen (1985) did not mention the species (possibly regarding it a non-forest species with no records from above 900 m?). Stonechat *Saxicola torquata*: Ukwama 1400-1500 m, Kimhandu 2520 m (1-2 pairs seen on the high altitude meadow), Lanzi 1680 m (common), Morningside 1500 m (common), Bunduki 1000 m (common). Seen in many places near villages and forest edges. Whinchat *S. rubetra*: Ukwama 1430-1600 m (common). First published record from the Ulugurus of this Palearctic migrant. **Cinnamon Bracken Warbler *Bradypterus cinnamomeus***: Kimhandu 2145-2600 m, Lanzi 1710-2500 m, Tchenzema 1700-2500 m. Surprisingly there were only two earlier published records from the Ulugurus of this species (Stuart and Jensen 1985). We found the species to be very common around our Kimhandu-5 (2520 m) camp on the big meadow and in the surrounding elfin forest (especially near the edge), which is clearly reflected in the plot data (Figure 5.1). At this locality it is found sympatrically with its congener *B. mariae* (see Appendix 5.5), although being more confined to edge habitats than the latter. We also recorded *B. cinnamomeus* frequently on the Lukwangule Plateau on the visits to this area above Tchenzema and Lanzi. Single individuals were recorded occasionally in big forest glades with bracken in the Kimhandu, Lanzi and Tchenzema areas down to 2140 m. Also recorded on a meadow surrounding the Mgeta stream at 1860 m and near the lower forest edge at Lanzi. Britton (1980) describes it as a wide-ranging and common bird of moist thickets, giant heather, bracken-briar and the undergrowth of forest and bamboo in the highlands at 900-2400 m (mainly above 2000 m). Mountain Yellow Warbler (Mountain Flycatcher-Warbler) *Chloropeta similis*: Ukwama 1430 m. There are two earlier published records from the Ulugurus (one from Nyingwa and one from Bunduki) (Friedmann 1928, Baker pers. comm. to Stuart and Jensen 1985). According to Britton (1980) this species occurs in shady places in bracken, bamboo and forest edges at 1800-3400 m. Willow Warbler *Phylloscopus trochilus*: Lukwangule Plateau 2500 m. First published record from the Ulugurus of this Palearctic migrant. Trilling Cisticola *Cisticola woosnami*: Singiza to Nyamigadu (very common) 1000-1500 m, Ukwama 1430 m (common), Lanzi 1680 m (fairly common), Tchenzema 1700 m (common), Morningside below 1400 m. Tawny-flanked Prinia *Prinia subflava*: Kimhandu 900 m (common), Bunduki common around 1000 m, Kigurunyembe 700-1000 m (common). Recorded often during the walk from Singiza to Nyamigadu (altitude not noted). White-eyed Slaty Flycatcher *Dioptrornis fischeri*: Ukwama 1430 m, Tchenzema 1700 m. First published records from the southern section of the Ulugurus. Britton (1980) describes the species as common in forest edges, woodland and gardens at 1300 to 3000 m. Black-and-white Flycatcher *Bias musicus*: Seen in Kimboza F.R. and just outside forest at Bunduki (1300 m). Also outside forest near Bwakira Juu (c. 340 m) and Dakawa (c. 300 m) villages on 30 September. Britton (1980) describes it as an adaptable species which is common in tall trees in gardens, woodland, bush land and forest edges as well as in the forest canopy (ranging from sea-level to 1700 m). One of the species which it is difficult to categorize into forest/non-forest species. Arrow-marked Babbler *Turdoides jardineii*: Kigurunyembe at 700-1000 m in woodland. Spotted Creeper *Salpornis spilonotus*: Ukwama 1430 m on a tree trunk in a field. First published record from the Ulugurus. **Collared Sunbird *Anthreptes collaris***: This species was recorded only in Kimboza Forest (fairly

common) and in the forest strip at Kigurunyembe 650-850 m (few seen and one mistnetted). Stuart and Jensen (1985) describe the species as being much commoner at low altitudes where it is more of a forest bird but there are records from up to 1800 m (forest and non-forest habitats). During a survey in the Udzungwa Mountains in 1991-92 (Ndundulu Forest, 1350-2400 m) *A. collaris* was seen deep inside forest up to at least 1550 m although usually at low densities (LAH and JOS). It therefore surprised us that we did not record it at any of the localities in the Uluguru North and South F.R.s. One of the species which it is difficult to categorize into forest/non-forest species. Variable Sunbird *Nectarinia venusta*: Tchenzema 1600 m, Morningside 1500 m, Bunduki 1000 m (common), Kimboza 300 m, Kigurunyembe 700-1000 m (woodland). Also recorded above Singiza (altitude not noted) and in other cultivated land areas passed on our way to and from the forests. **Black-backed Puffback *Dryoscopus cubla***: The species was recorded frequently in Kimboza F.R. during the visit by JF and JK. Also Stuart and Jensen (1985) describes it as being common in Kimboza. It was fairly common in the forest strip at Kigurunyembe at 650-850 m and was also recorded in woodland outside this strip. Also at Tchenzema we found it inside forest (recorded on two of 25 plots, see Table 5.9) whereas it was not recorded on the other forest localities visited. Recorded at the following non-forest localities during our survey: Singiza 440 m (common), Nyamigadu area 1500 m, Lanzi 900 m (fairly common), Tchenzema 1700 m, Bwakira 340 m, and Dakawa 300 m. Apart from Kimboza the only earlier published records were from Bunduki and Morningside. Britton (1980) describes the species as wide-ranging and often common up to 2200 m in forest edges and strips, woodland, gardens and sometimes the interior of larger tracts of forest. It would perhaps be most correct to regard it a "forest species". **Tropical Boubou *Laniarius aethiopicus***: Recorded frequently in Kimboza F.R. during the visit there by JF and JK. Above Tchenzema it was recorded inside forest on four of 25 plots (see Tables 5.9; the four plots were at 2000-2050 m). Records made at non-forest localities during our survey: Singiza 440-800 m (very common), Ukwama 1500 m, Lanzi 900 m (fairly common), Tchenzema 1700 m and Morningside below 1500 m. Black-crowned Tchagra (Black-headed Tchagra) *Tchagra senegala*: Singiza 440 m, Bunduki below 1300 m. Only the second and third published records from the Ulugurus since Friedmann and Loveridge's (1937) first record. Sulphur-breasted Bush Shrike *Telophorus sulfureopectus*: Bunduki 1300 m. First published record from the Ulugurus. **Retz's Red-billed Helmet Shrike *Prionops retzii***: Stuart and Jensen (1985) describe this species as common in Kimboza and it was also recorded there on some occasions during our survey. There is an earlier record from Morningside, 1200 m. According to Britton (1980) the species is widespread, but seldom common, in woodland from sea-level to 1990 m (mainly below 1500 m). Fork-tailed Drongo *Dicrurus adsimilis*: Bunduki 1000 m (common). First published record from the Ulugurus of this common species. Pied Crow *Corvus albus*: Kimhandu 1940 m, Lanzi 900 m (common). White-necked Raven *C. albicollis*: Ukwama 1430, Kimhandu 1520-2520 m (common), Lanzi 900-2500 m, Tegetero 1345-1950 m, Tchenzema 2500 m, Bunduki 1300 m (breeding record), Kigurunyembe 700-1000. A common species which was often seen and heard soaring above the canopy or surrounding cultivations. Red-winged Starling *Onychognathus morio*: At Kimhandu (the only locality where we recorded it on this survey) it was seen occasionally in the canopy and more often in big flocks flying over the forest at 1700-2000 m. Stuart and Jensen (1985) describe it as widely distributed from the foothills up to at least 1800 m, especially in the vicinity of rock faces and settlements. Bertram's Weaver *Ploceus bertrandi*: Tchenzema 1600 m. Several seen from the roadside west of the mountains. [[Speke's Weaver *P. spekei*: Ukwama 1430 m. There were no earlier published records from the Ulugurus. According to Britton (1980), this species (which is a gregarious resident and wanderer, frequenting a variety of open country with trees or bushes at 1200-2000 m, especially in modified habitats near habitation) is not known from south of the Arusha-Kilimanjaro area. Recently it has been found further south in Singida, however (N.E. Baker *in litt.*). The species looks relatively characteristic on our colour plates, but since plumage variation in relatively similar-looking species, e.g. African Masked Weaver (Vitelline Masked Weaver) *P. vitellinus* cannot be excluded (the eye-colour also differing between the two species, however), it is best to regard our single observation with some caution, pending further studies in the Ulugurus]]. Golden Weaver *P. subaureus*: Lanzi 900 m (common). Not recorded since the specimens collected by Andersen (Andersen in Stuart and Jensen 1985) and by Loveridge (Friedmann 1928). African Masked Weaver (Vitelline Masked Weaver) *P. vitellinus*: Ukwama 1430 m. First published record from the Ulugurus. African Firefinch *Lagonostica rubricata*: Morningside 1500 m. Yellow-bellied Waxbill *Estrilda quartinia*: Ukwama 1400-1600 m (common), Lanzi 900 m (common to very common), Tchenzema 1700 m (very common), Morningside below 1500 m (common). Common Waxbill *E. astrild*: Ukwama 1400-1450 m (very common), Tchenzema 1700 m. Bronze Mannikin *Lonchura cucullata*: Singiza 440 m (very common). Rufous-backed Mannikin *L. nigriceps*: Singiza 440 m. In Britton (1980), a subspecies of the Black and White Mannikin *L. bicolor*. African Citril *Serinus hypostictus*: Tchenzema 1600 m. Cabanis's Bunting *Emberiza cabanisi*: Ukwama 1430 m.

Appendix 5.7. Observations of mixed feeding parties from our survey.

Many of the species occurring in the Eastern Arc forests take part in mixed feeding parties regularly, and a considerable diversity of flock structures have been seen in Eastern Arc Mountains, from very mobile large parties which go on for hours with *Dicrurus ludwigii* and other core species ("drongo parties") to brief activity bursts involving few species, none of which can be called "core species" (JF, LAH and JOS). Understorey species sometimes form their own parties.

Our survey revealed some interesting differences between the submontane areas of the Uluguru North F.R. on one hand and the montane areas of the Uluguru South and North F.R.s on the other. Only few parties were studied in detail, however, and the descriptions below are therefore kept in general terms.

Tegetero. Mixed feeding drongo parties (here defined as parties including typical party species like *Dicrurus ludwigii*, *Ploceus bicolor*, *Phyllastrephus flavostriatus*, *Apalis melanocephala*, *Telophorus nigrifrons* and *Coracina caesia*) were a very typical phenomenon below 1450 m.

Other species seen in the drongo parties include (* indicates that most observations below 1500 m are of birds in drongo parties): *Apaloderma vittatum*, *Stactolaema olivacea**, *Pogoniulus leucomystax*, *Dendropicus griseocephalus**, *Terpsiphone viridis**, *Andropadus olivaceiceps*, *A. masukuensis*, *Apalis chariessa**, *A. thoracica*, *A. chapini*, *Phylloscopus ruficapillus*, *Trochocercus albonotatus*, *Muscicapa adusta*, *Laniarius fuelleborni*, *Nectarinia loveridgei*, *N. olivacea*, *Onychognathus walleri* and *Zosterops senegalensis*.

The drongo parties were generally immobile, as they often stayed in almost the same area for hours and sometimes foraged quietly for long periods. It was our impression that the density of parties was high, but we often found it difficult to distinguish different parties with certainty. We believe that the low mobility and the frequent silence of the parties should be explained by the fact that we were in the beginning of the breeding season (see Appendix 5.11). Some structurally loose parties without *Dicrurus ludwigii* but including both *Phyllastrephus flavostriatus* and *Ploceus bicolor*, sometimes *P. bicolor*, *Coracina caesia* and *Telophorus nigrifrons* but not *Phyllastrephus flavostriatus*, were observed between 1460 and 1550 m. A few parties without any of the core species of drongo parties were seen above 1700 m. A few parties of understorey species were seen at Tegetero.

Kimhandu and Lanzi.

Whereas mixed feeding parties were common at Tegetero near the two lowest stations, only few and brief mixed feeding parties were recorded at Kimhandu and Lanzi where the forest is generally situated above 1500 m. We did not record the typical feeding party species *Ploceus bicolor*, *Phyllastrephus flavostriatus* and *Apalis melanocephala* in the southern section, and *Dicrurus ludwigii* was recorded on only a single occasion (a pair seen in the lowest part of the forest near Kimhandu-6 [1540 m], not in a feeding party; first published record from the Uluguru South). Two other species often seen in drongo parties but which generally have a wider altitudinal tolerance were present: *Telophorus nigrifrons* and *Coracina caesia*. At Kimhandu *Telophorus nigrifrons* occurred at unexpectedly low densities and *C. caesia* was seen only near our 1940 m station (few observations). At Lanzi, these two species appeared more common than at Kimhandu but clearly occurred at much lower densities than near the two lowest stations at Tegetero.

The following species were seen participating in feeding parties or brief feeding bursts: *Pogoniulus leucomystax*, *Alcippe abyssinica*, *Andropadus olivaceiceps*, *A. masukuensis*, *A. virens*, *Phyllastrephus placidus*, *Pogonocichla stellata*, *Apalis thoracica*, *A. chapini*, *Phylloscopus ruficapillus*, *Trochocercus albonotatus*, *Batis mixta*, *Terpsiphone viridis*, *Laniarius fuelleborni*, *Telophorus nigrifrons*, *Muscicapa adusta*, *Nectarinia loveridgei* and *Zosterops senegalensis*.

Species that frequently took part in drongo parties at Tegetero were generally seen feeding individually at Kimhandu and Lanzi, e.g. *Terpsiphone viridis*. It should be noted that we visited the Kimhandu and Lanzi areas in the beginning of the breeding season (see Appendix 5.11) and that in general mixed species flocks are a more common phenomenon in the dry season.

Tchenzema. No feeding parties were recorded during the brief visit here.

Kimboza.

Many mixed feeding flocks were seen with *Dicrurus ludwigii* almost invariably present. Like at Tegetero the parties appeared to stay long periods in a small area. It is of interest that *Andropadus virens*, which foraged solitarily and within its territories in the lower parts of the Kimhandu area, was generally very active in mixed feeding parties in Kimboza F.R. This, together with the above-mentioned example with *Terpsiphone viridis*, suggests that *Dicrurus ludwigii* (and other core species) are important for the formation of mixed feeding parties.

Comparing with the Udzungwas, it is interesting that during research in the Ndundulu Forest in the Udzungwas 1991-92 (LAH and JOS) mixed feeding parties of the drongo party type were a common phenomenon up to c. 1800 m.

Appendix 5.8. Seasonal altitudinal migration - indications from this survey and from the literature.

(See Footnote 5¹³ in the end of this appendix for an explanation of the phenomenon of seasonal altitudinal migration). Some of the bird species that breed in the mountain forests appear to depend on low altitude forest in the dry season. For the conservation of the population of such species it is necessary to protect not only their mountain habitats, the lowlands must also be protected.

¹³ A number of montane breeding Eastern Arc forest bird species are suspected to move to lower altitudes in the cold (dry) season. In the Usambaras the downward movement generally takes place from March to April, and the birds return in September-October to their breeding areas at higher altitudes (Stuart *et al.* 1993). The pattern of movement is probably rather much the same in other Eastern Arc ranges. Among some species, such as *Pogonocichla stellata*, probably the bulk of the population migrates to lower elevations (Stuart *et al.* 1993 and below) but other species migrate only on a small scale. In general the foothill forests and the lower parts of the submontane forests are believed to be of high importance for the migrants in the off-breeding season. Some individuals of very migratory species like *P. stellata* and *Cercococcyx montanus* (the migratory pattern of the latter probably being quite complex, but see below) do, however, sometimes migrate as far away as to the coastal forests in the dry season (Baker 1984; Britton *et al.* 1980).

During fieldwork in the Udzungwa Mountains 1991-92 (Ndundulu Mountains, forested from 1350 to 2400 m), very clear seasonal differences were observed for four species: *Pogonocichla stellata*, *Terpsiphone viridis*, *Cercococcyx montanus* and *Smithornis capensis* (altitudinal migration in the latter species was actually not mentioned by Keith *et al.* 1992). All four occurred at very low densities when the field stations (1350, 1540, 1710 and 2140 m altitude) were visited in July-September (part of the dry season) but they were abundant when the fieldwork programme was repeated in November-January (season of short rains) (LAH and JOS). Also other species were most abundant in the latter field period but with a less pronounced difference, including *Aplopelia larvata*, *Zoothera gurneyi*, *Andropadus olivaceiceps*, *Apaloderma vittatum* and *Muscicapa adusta*. A similar pattern may be found in the Ulugurus. It should be stressed, however, that for a given species the pattern and extent of migration may well differ between mountain ranges (see Dowsett-Lemaire 1989 for a discussion of this, based mainly on Malawian montane forests but including also results from other Afromontane forests). The pattern may furthermore change from year to year.

Stuart *et al.* (1993) briefly summarized the knowledge on altitudinal migration in the Eastern Arc. The following list is compiled from their paper supplemented with data from the Cambridge Tanzania Rainforest Project (1994). For some of the species the assumption is based on very few observations from lowland forest or from low altitude submontane forest in the off-breeding season.

List of strictly montane breeding species known or believed to undertake seasonal vertical migration in the Eastern Arc:

(Ul = Ulugurus; Ud = Udzungwas; Us = Usambaras).

Columba arquatrix (Ud), *Aplopelia larvata* (Ul, Ud), *Cercococcyx montanus* (Ul, Ud, Us), *Apaloderma vittatum* (Ul, Us), *Dendropicos griseocephalus* (Us), *Alcippe abyssinica* (Us), *Andropadus masukuensis* (Us), *A. (t.) neumanni* (Ul, Us), *A. olivaceiceps* (Ul, Us), *Alethe fuelleborni* (Ul, Us, Ud), *Modulatrix stictigula* (Ul), *Sheppardia sharpei* (Us), *Pogonocichla stellata* (Ul, Us, Ud), *Zoothera gurneyi* (Ud, Us), *Trochocercus albonotatus* (Ul, Us), *Telophorus nigrifrons* (Ul, Ud, Us), *Onychognathus walleri* (Us), *Poeyoptera kenricki* (Ul, Us), *Anthreptes rubritorques* (Us) and *Cryptospiza reichenovii* (Us).

Some montane breeding species which also have breeding populations in the lowlands or in non-forest habitats (wherefore they are not included in the list above) are also believed to migrate altitudinally to various extents. They include *Terpsiphone viridis* (regarded an "intra-African migrant" at least in parts of Africa), *Smithornis capensis* (see comments above under the Udzungwa Mts.), Black Cuckoo Shrike *Campephaga flava* (regarded an "intra-African migrant" at least in parts of Africa), *Coracina caesia* and *Muscicapa adusta* (e.g. Stuart 1983 and above).

A three weeks general survey in the large lowland Matundu Forest (at the base of the Udzungwas, c. 400 m) in September 1994 revealed that *Pogonocichla stellata* was abundant whereas the rest of the assemblage of species suspected to migrate altitudinally were recorded only in low numbers (T. Lehmberg pers. comm.). Of the above-mentioned species the following were recorded: *Cercococcyx montanus* (some singing, not many), *Coracina caesia* (one seen), *Campephaga flava* (fairly common), *Smithornis capensis* (some singing), *Zoothera gurneyi* (one mistnetted), *Alethe fuelleborni* (possibly heard at 2-3 occasions), *Telophorus nigrifrons* (some seen). Matundu was dry at the time of the visit. Dryness may be a limiting factor on the amount of food available (in Matundu as well as in Kimboza).

The seasonal altitudinal migration has never been studied in detail in the Eastern Arc, and the knowledge about this phenomenon is still very incomplete. It may turn out that some of the species, whose populations in the Eastern Arc are regarded as strictly montane breeding, have a scattered occurrence in the lowlands throughout the year as is the case in other parts of Africa for some of them. Some of the occurrences in lowlands may also best be explained by exploratory movements - in Malawi, e.g. *Apaloderma vittatum*, *Telophorus nigrifrons*, *Aplopelia larvata* and *Coracina caesia* have been shown to undertake exploratory inter-forest movements, the first two species up to 100 km, the last two up to 80 km, through inhospitable terrain (Dowsett-Lemaire 1989). Some species of the Malawian forests undertake intra-African migration, which cannot be termed altitudinal migration (Dowsett-Lemaire 1989).

Two of the restricted-range species in the Ulugurus can be found in the foothill forests at least part of the year, one of them (*A. fuelleborni*) having been found in good densities. In this section we have collected those of our own observations that are related to the phenomenon of vertical migration and have supplemented them with previous records of the same kind (listed in Stuart and Jensen 1985), in an attempt to assess what is actually known about this phenomenon in the Ulugurus at present. For some of the species the records could be explained by other types of movements than "ordinary" seasonal vertical migration (see footnote) or the species may prove to breed in the lowland forests. It is clear that the knowledge on vertical migration in the Ulugurus is still scanty.

1. *Aplopelia larvata*. Kimboza Forest, 300 m, in July (Stuart and Jensen 1981). One heard singing in the forest strip at Kigurunyembe, 700 m, on 7 December 1994 (JF and JK) - unusual with an observation from such a low altitude at this time of the year.
2. *Cercococcyx montanus*. One juvenile male from "East Uluguru", 400 m, in February (Andersen in Stuart and Jensen 1985). Recorded in Kimboza Forest in October during our survey. So, the species can be found in the lowlands also in what is normally considered the early breeding season of mountain forest birds.
3. *Apaloderma vittatum*. Kimboza Forest in August (Andersen in Stuart and Jensen 1985) and Kibungo Forest, 300 m, in June and September (Moreau in Stuart and Jensen 1985; Fuggles-Couchman, pers. comm. to Stuart and Jensen 1985). Andersen collected a specimen at 400 m "east of Uluguru" (Britton 1981).
4. *Andropadus olivaceiceps*. Andersen specimen from Kimboza Forest in July (Stuart and Jensen 1985). Kibungo Forest in June (Moreau in Stuart and Jensen 1985).
5. *Zoothera gurneyi*. Single bird heard at Kigurunyembe, 700 m, on 7 December 1994 (JF and JK) (mentioned here though admittedly not in the foothills).
6. *Alethe fuelleborni*. Kibungo and Kimboza Forests, 250-300 m, in June and July (Moreau in Stuart and Jensen 1985; Stuart and Jensen 1981). Stuart and Jensen (1981) described it as being common in Kimboza Forest in July 1981. Two individuals were mistnetted in Kimboza Forest on 17-19 October during our survey (of a total capture of 19 birds at that locality!). These captures are from what is normally considered the early breeding season of mountain breeding species. Further fieldwork in Kimboza is necessary to clarify the significance of this forest for *A. fuelleborni*. JF has found the species to be common in September-October in many other Tanzanian foothill forest (Rubehos, Mt. Kanga, Ngurus).
7. *Pogonocichla stellata*. All records from below 1000 m are from June and July, including several from the Ngerengere River, 600 m, 10 km N of the Uluguru Mountains (Andersen in Stuart and Jensen 1985). Recorded frequently during fieldwork in Kimboza Forest July 1981 (Stuart and Jensen 1981). Heard once at Kigurunyembe, 700 m, on 7-8 December 1994 (JF and JK).
8. *Bradypterus mariae*. Kibungo Forest in June (Moreau in Stuart and Jensen 1985). Kimboza Forest medio October 1994, single bird (JF and JK).
9. *Trochocercus albonotatus*. Kibungo Forest in June (Moreau in Stuart and Jensen 1985).
10. *Modulatrix stictigula*. There is an Andersen record from bushland at 600 m (Britton 1981, Stuart and Jensen 1985). This record is extraordinary as there are no other indications of migratory/exploratory movements of this species.
11. *Telophorus nigrifrons*. Kibungo and Kimboza Forests in June and July (Moreau in Stuart and Jensen 1985; Stuart and Jensen 1981).
12. *Poeoptera kenricki*. Kimboza Forest in July (Stuart and Jensen 1981).

Also *Terpsiphone viridis*, *Smithornis capensis*, *Coracina caesia* and *Muscicapa adusta* must be suspected to migrate altitudinally (see footnote). They are not included in the list above because they cannot be considered strictly montane, being known from coastal lowland forests too. *Terpsiphone viridis* and *Muscicapa adusta* had not previously been recorded in Kimboza F.R. but were recorded there during our visit.

When we arrived to the Uluguru South F.R. on 1 October, all local species for which we assume the seasonal fluctuations are conspicuous (e.g. *Pogonocichla stellata* and *Terpsiphone viridis*) were present and common. We did not see any signs of an increasing density during our survey (due to frequent movings between camps we could have overlooked day to day changes, however). This indicates that most of the populations had arrived by the time we started the survey.

The distance to fly from the nearest points of the Uluguru North and South F.R.s to groundwater forests in the foothills is at least 15 km. The distance from e.g. the Kimhandu area is much longer (at least 25 km). Scharff *et al.*

(1982) mentioned that the migration pattern may differ between the eastern and the western slope of the Uluguru North F.R.

Appendix 5.9. Further notes on the general characteristics of the forest avifaunas at the localities visited.

5.9.a. Submontane evergreen forest.

In addition, for three of the species assumed to exhibit seasonal fluctuations in abundance (see Appendix 5.8) the submontane habitat supports much higher densities than the montane. These are *Smithornis capensis*, *Terpsiphone viridis* and *Cercococcyx montanus*. However, *Smithornis capensis* was very uncommon in the Uluguru South: At Kimhandu it was recorded only at 1700 m altitude and at Lanzi it was not recorded at all. This species clearly prefers submontane forest. *Cercococcyx montanus* also occurred at low densities in the Uluguru South F.R., being more common in the submontane and lower montane areas in the Uluguru North F.R. For a further discussion of these two species: see Appendix 5.5. *Terpsiphone viridis* was relatively common in the montane forests in the Uluguru South F.R. but clearly occurred at higher densities in the submontane areas of the Uluguru North.

Tegetero-1 (1345 m, in the submontane belt) and Tegetero-2 (1535 m, higher submontane-lower montane belt) are the most species rich of our study areas (Table 5.5¹⁴). The high numbers should be explained by the occurrence of typical drongo party species plus species recorded nowhere else (e.g. *Malaconotus alius* and *Apalis chariessa*) in combination with the occurrence of most of the species occurring in the montane zone. The species richness is reflected in the plot data but not in the mistnetting data - the set of species prone to mistnetting is largely the same as on many other stations.

5.9.b. Montane evergreen forest.

Some differences caused by variations in the character of the forest and the altitudinal position of the lower forest edge:

The avifauna appears to be of a montane character further down in the study area at Lanzi than in the study area at Kimhandu, since three species typical of high altitudes (*Andropadus (t.) neumanni*, *Cossypha anomala* and *Apalis thoracica*) are common down to the lower forest edge at Lanzi whereas they are not common below 1900 m at Kimhandu (Tables 5.8 and 5.9). For *Alethe fuelleborni*, a restricted-range species which at Kimhandu was most common at the lower stations, the lack of forest below 1600 m at Lanzi, probably in combination with the apparently more montane character at Lanzi, appears to have caused lower densities here - only 1.6 individuals were mistnetted per 2500 MNH (Table 5.8).

At Tchenzema on the drier western slope of the mountains, the sharp lower forest edge is at 1900-2050 m. The forest interior is strongly disturbed by man in the lower part of the gradient at this locality. The tree height was generally only 10-15 m, even in the lowest parts. The open forest structure (combined with proximity to lower edge) at Tchenzema is probably the explanation of the occurrence of two non-forest species *Dryoscopus cubla*¹⁵ (scored on two of 25 plots; 2000 m, 2150 m) and *Laniarius aethiopicus*¹⁶ (scored on four of 25 plots; 2000 m, 2000 m, 2000 m, 2050 m). (Interestingly, neither *L. aethiopicus* nor *Dryoscopus cubla* were recorded by Scharff *et al.* (1982) during their brief visit to the Tchenzema area in 1981). These two species were not recorded at Kimhandu, Lanzi or Tegetero. The open structure of the forest at Tchenzema also favours species like *Laniarius fuelleborni* and *Cossypha anomala*, their abundance being well illustrated by the plot data (Table 5.9, Figure 5.1.m). Both were common not only in the montane zone above Tchenzema but also on the Lukwangule Plateau.

Certain species, which could potentially be present, appear to be missing at Tchenzema. It is not surprising that the following species have not been recorded, since they are mainly submontane and lower montane species and are also absent or only recorded rarely (always below 1900 m) on the eastern slopes at Kimhandu and Lanzi:

¹⁴ From Table 5.5 it is clear that species have been overlooked at some of the stations. Nonetheless it is possible to compare the stations considering the total number of species recorded, with some care (click on the footnote number to return to text).

¹⁵ *Dryoscopus cubla* is generally a species of forest edges (for which reason it was maybe best to treat it as a forest species).

¹⁶ *Laniarius aethiopicus* occupies a range of habitats (click on the footnote number to return to text).

Smithornis capensis (very few records from Kimhandu, none from Lanzi), *Dicrurus ludwigii* (one record from Kimhandu, none from Lanzi), *Phyllastrephus flavostriatus*, *Alethe fuelleborni*¹⁷, *Apalis melanocephala* and *Ploceus bicolor*.

However, certain species which have been recorded above 1900 m at Kimhandu and Lanzi appear to be missing or occur at very low densities at Tchenzema since they went unrecorded by this brief survey and the brief survey described in Scharff *et al.* (1982):

Ceratogymna brevis, *Sheppardia sharpei* (also lacking at Lanzi-3 [2110 m], however), *Terpsiphone viridis*, *Cercococcyx montanus* (uncommon at Kimhandu and Lanzi, however) and *Poeoptera kenricki* (generally uncommon and therefore easy to overlook).

Species recorded at Tchenzema by Scharff *et al.* (1982) but not during this survey (indicating that they are scarce) include:

Apalis chapini, *Phyllastrephus placidus* and *Telophorus nigrifrons*.

Andropadus masukuensis was scarce at Tchenzema, probably because of the lack of epiphytes on the tree trunks in this disturbed habitat, combined with altitudinal effects.

At Lanzi-2 (1920 m), the number of species mistnetted is low compared to the general pattern whereas at Lanzi-1 (1710 m), only 20 minutes walk from Lanzi-2, the number is high compared to the general pattern (Figure 5.2). In addition, the plot data indicate that the species diversity is higher at Lanzi-1 (34 forest species on 16 plots) than at Lanzi-2 (29 forest species on 17 plots) (Figure 5.3). On the dawn tape recordings 21 forest species were recorded at Lanzi-1 against 16 forest species at Lanzi-2. A possible explanation for the low bird species richness at Lanzi-2 is that Lanzi-1 is situated close to the forest edge in a mixture of clearings and dense forest (leading to a high diversity in the mosaic of microhabitats?) whereas Lanzi-2 is situated on a broad ridge where the vegetation is structurally more uniform and drier. There are no indications of a higher general bird density at Lanzi-1 than at Lanzi-2: the mistnet catch rate at Lanzi-2 (75.8 individuals per 2500 MNH, Table 5.8) is somewhat higher than at Lanzi-1 (59.1 individuals per 2500 MNH) and actually quite high, and the mean number of species per plot is rather similar for the two stations (Table 5.9).

5.9.c. Lowland semi-evergreen forest.

Kimboza F.R. holds a higher percentage of species which we have categorized as non-forest species than do the Uluguru North and South F.R.s. Examples of non-forest species that were recorded frequently during the brief visit by JF and JK are Green Pigeon *Treron calva*, Broad-billed Roller *Eurystomus glaucurus*, Collared Sunbird *Anthreptes collaris*, *Dryoscopus cubla*, *Laniarius aethiopicus* and Retz's Red-billed Helmet Shrike *Prionops retzii* with records also of other non-forest species inside forest or near edges (see Appendix 5.6. Stuart and Jensen [1985] mention some additional species). Many of these lowland species admittedly occur in many East African lowland forests or in the edges of these, for which reason one could be tempted to classify them as forest species, but they are so widely distributed in non-forest habitats that we decided to classify them as non-forest species. In addition, some Kimboza species categorized in this report as forest species have a rather broad habitat range, e.g. *Muscicapa caerulescens*, *Bias musicus*, *Pyrenestes minor* and *Hypargos niveoguttatus*. When JF and JK visited the forest during our survey, the ground stratum was very dry, and most species apparently foraged in the mid and upper strata.

The significance of lowland forest for montane breeding species suspected to migrate downwards in the off-breeding season was mentioned in Appendix 5.8.

Kimboza F.R. is apparently the only of the foothill forests that is reasonably well investigated. The larger Ruvu F.R. is adjacent to Kimboza but we have not come over any ornithological records published with Ruvu mentioned as locality. Ruvu is disturbed locally from ruby mining, licensed and unlicensed, as the reserve is one of the most important localities for this gemstone in Tanzania. For tree species Lovett and Pócs (1993) mention that the western half of Ruvu F.R. is covered with seasonal lowland forest similar to that of Kimboza, but with fewer species. Ruvu may hold an important avifauna similar to that of Kimboza but surveys are necessary before we can say anything about this. In addition, the other forested parts of the karst limestone landscape below the eastern slopes of the

¹⁷ This species is best recorded with mistnetting but no mistnetting has been carried out at Tchenzema (click on the footnote number to return to text).

Uluguru Mountains may hold important forest avifaunas. There are several humid thickets along the edge of the Mwina and Mtego river plains.

Appendix 5.10. Notes on *Arcanator orostruthus*, *Swynnertonia swynnertoni* and *Anthreptes pallidigaster*.

Dappled Mountain Robin *Arcanator orostruthus*.

Known from Mount Namuli in Mozambique (from two birds collected at 1465 m in the 1930ies), the Usambara Mountains (discovered in the early 1930ies, known only from 900 m altitude near Amani) and the Udzungwa Mountains (discovered 1981, recorded from 1250 to 1750 m, found in four forest patches and locally relatively common) (Collar and Stuart 1985, Moyer 1993, Dinesen *et al.* 1993), the three populations being classified as different subspecies. In the Ndundulu and Nyumbanitu Forests in the Udzungwa Mountains, the species appears to prefer luxuriant forest, especially where there is dense undergrowth of tall herbs (Dinesen *et al.* 1993, LAH and JOS pers. obs. 1994). Moyer (*in litt.* to Collar *et al.* 1994) describes its preferred habitat in the southern section of the Udzungwa Scarp F.R. as forest with closed canopy and with a dense growth of Zingiberaceae in the ground stratum, between which it moves through corridors of thick growth growing around light gaps and along streams.

The forest areas below 1700 m altitude in the Uluguru North F.R. appear to offer suitable conditions for the species, e.g. in the Bagiro area where there is forest down to c. 1100 m. The species is quite vocal and relatively easy to detect (although hard to see). If overlooked in the Ulugurus, it must be very local or occur at only low densities.

Stuart (1981b) suggested that the disjunct distribution of *Arcanator orostruthus* could be explained by competitive exclusion by its congener *Modulatrix stictigula*. However, the two species has afterwards been found coexisting at four localities in the Udzungwa Mountains, sometimes with both species occurring at good densities in areas of sympatry (Stuart *et al.* 1987, Jensen and Brøgger-Jensen 1992, Moyer 1993, Dinesen *et al.* 1993). The relatively small amount of forest habitat in the submontane and lower montane zone may be part of the explanation of its absence in the Ulugurus but this is certainly a question which calls for further studies.

Swynnerton's Robin *Swynnertonia swynnertoni*.

Until the 1980es known only from three localities in eastern Zimbabwe (900-1700 m) and from Mount Gorongosa in Mozambique (850-1750 m) (Collar and Stuart 1985). In 1981 it was discovered in the Udzungwas where it is now known from three forest patches (1000-1700 m, being fairly common in the southern part of the Udzungwa Scarp F.R.) (Collar and Stuart 1985, Stuart *et al.* 1987, Jensen and Brøgger-Jensen 1992, Moyer 1993, Dinesen *et al.* 1993) and in the 1990'ies, it has been discovered in several Usambara foothill forests (Evans and Anderson 1992 and 1993b, Cambridge Tanzania Rainforest Project 1994). The two populations in Tanzania form separate subspecies.

Especially the lower parts of the Uluguru North F.R. seem to offer fine conditions but, if overlooked, *S. swynnertonia* (who's melancholy two-three note song is very characteristic) must occur at very low densities. Also for this species the small amount of forest habitat in the submontane and lower montane zone may be part of the explanation but the question calls for further studies.

Amani Sunbird *Anthreptes pallidigaster*.

Known from the coastal Sokoke-Arabuko Forest in Kenya, the East Usambara Mountains (from the foothills up to 900 m) and discovered as late as 1991 in the Udzungwa Mountains (from 1400 to 1550 m, rare and occurring only locally in the Ndundulu and Nyumbanitu Forests where it is uncommon and local) (Collar and Stuart 1985, Dinesen *et al.* 1993, Cambridge Tanzania Rainforest Project 1994, LAH and JOS pers. obs. from the Nyumbanitu Forest 1994).

This unobtrusive and diminutive species which have recently been found in small numbers in the Udzungwas, far south of its formerly known distribution in the Usambaras and Sokoke-Arabuko, could easily be overlooked if occurring at low densities in the Uluguru North or the Kimboza/Ruvu F.R.s.

Appendix 5.11. Breeding activity noted among forest birds during our survey.

We provide evidence of breeding activity as defined below, in order to give a rough overview of the breeding status of the various species:

- Juvenile and immature birds mistnetted (listed in Tables 5.5-6).
- Birds mistnetted with brood patch (BP) 5 or with vasculated (V), wrinkled (W), scaly (S) or refeathering (RF) BP of lower score (brood patch was scored on most but not all birds mistnetted). Listed below (please compare with Table 5.5 to see total number of individuals mistnetted of the species at the various stations; species for which no individuals had BP 5 or with wrinkled or refeathering BP of lower score are not mentioned in the list below). Abbreviations for stations are those used in Table 5.5. No manual exists showing the size of the brood patch for the various species at different times of the year so it is possible that for certain species we should have listed also brood patches of lower score. Further information on, e.g. moulting patterns, brood patch scores other than those listed here etc., is available on disks.
- Nestlings and juvenile birds observed in the field (probably not all juveniles observed have been noted due to time constraints; records should be regarded as positive, not complete, evidence) (listed below).
- Observations of nesting individuals (listed below).
- Adult birds with nesting material or warning with insects in their bill (listed below).

Circaetus fasciolatus: A single juvenile bird was seen in Kimboza F.R. in October. *Accipiter tachiro*: At Tegetero a young bird was calling from a nest at 1345 m. *Buteo oreophilus*: A nestling was seen in a tree in a forest glade at Lanzi, 2000 m, 8-19 November. *Stephanoaetus coronatus*: We found an active nest in a big *Ficus* tree on the roadside in Kimboza F.R. in October. *Columba arquatrix*: At Kimhandu a nest with downy young was found at 2520 m on 23 of October and at 2580 m another active nest was found. *Aplopelia larvata*: A nest with two young birds was found at Lanzi, 2030 m, on 15 November. One with BP 5W mistnetted at Lan-3. *Apaloderma vittatum*: One with BP 5S mistnetted at Kim-2, one with BP 5WS mistnetted at Teg-2. *Ceratogymna brevis*: A male was seen feeding a female through a nesthole during the visit in Kimboza Forest on 17-19 October. *Pogoniulus leucomystax*: One with BP 5W at Kim-5. *Dendropicos griseocephalus*: Seen in a nesthole at Kimhandu, 1540 m, on 3 October and at Lanzi, 1770 m, on 5 November, but it was not clear whether the birds were breeding or just visited the nestholes for other reasons. *Smithornis capensis*: One with BP 5 at Teg-2. *Andropadus masukuensis*: One with BP 5 and one with BP 4W at Kim-2, two with BP 5W and one with BP 4W at Kim-3, one with BP 5W and one with BP 4W at Kim-4, one with BP 5W at Kim-6, one with BP 5RF at Lan-1, one with BP 5 at Lan-1, three with BP 5W at Lan-3, one with BP 5W, one with BP 5 and one with BP 4W at Teg-1, one with BP 5W and one with BP 5 at Teg-2, one with BP 5RF and one with BP 5 at Teg-3. *A. (t.) neumanni*: One with BP 5W at Lan-3. *A. olivaceiceps*: A pair warning, with insects in their bill, was seen at 1485 m altitude at Tegetero on 7 December. One with BP 4W at Kim-3. *A. virens*: A nest with two eggs was found close to the Kimhandu-1 (1520 m) camp on 10 October. One with BP 5 at Kim-1. *Phyllastrephus placidus*: One with BP 5W and one with BP 5 and one with BP 4RF at Kim-3, one with BP 4W at Kim-4, one with BP 3RF at Lan-2, one with BP 5 at Teg-1, one with BP 4W at Teg-2, one with BP 5 at Teg-3 and one with BP 4RF at Teg-3. *Alethe fuelleborni*: One with BP 5W at Teg-1, one with BP 5W at Teg-2. *Sheppardia sharpei*: One with BP 5VW at Teg-1, two with BP 5W at Teg-2. *Cossypha anomala*: One with BP 5W at Lan-1, one with BP 5W at Lan-2, one with BP 5W at Lan-3. *Turdus olivaceus*: Seen with nest material at Tegetero, 1610 m, on 9 December. One with BP 5W at Lan-1, one with BP 5WS at Teg-2, one with BP 5W at Teg-3. *Zoothera gurneyi*: One with BP 3W at Teg-2. *Pogonocichla stellata*: One with BP 4W at Teg-1 (48 adult individuals were scored for brood patch!). *Bradypterus mariae*: One with BP 4W at Lan-3. *Bathmocercus winifredae*: One with BP 4W at Lan-1. *Apalis thoracica*: A family group with three young and two adults was seen foraging at close range on 16 December at 1500 m in the forest of Tegetero. One with BP 5W at Kim-5, one with BP 4W at Lan-1, one with BP 4W at Lan-2, one with BP 5W at Lan-3. *Orthotomus metopias*: One with BP 4W was at Kim-6, one with BP 4W at Teg-2. *Batis mixta*: One with BP 5 at Lan-1. *Trochocercus albonotatus*: One with BP 5 at Lan-1. A newly fledged young was seen at Tegetero, 1430 m, on 15 December. *Alcippe abyssinica*: One with BP 5W at Lan-3. *Modulatrix stictigula*: One with BP 4W at Kim-3, one with BP 3RF at Teg-3, one with BP 5 at Teg-1. *Nectarinia olivacea*: One with BP 5 and two with BP 4W at Teg-1. *N. loveridgei*: A newly fledged young individual was seen on 2 October at Kimhandu, 1550 m, and a female accompanied by a juvenile was observed on 12 December. One with BP 5W, one with BP 4W, two with BP 5, two with BP 5RF and one with BP 4RF at Kim-1, three with BP 5W and two with BP 5RF at Kim-2, three with BP 5W and one with BP 4W at Kim-3, four with BP 5W and one with BP 4W at Kim-4, one with BP 5W and one with BP 5 at Kim-5, three with BP 5W, four with BP 4W, one with BP 5 and one with BP 2RF at Lan-1, three with BP 5W, two with BP 4W

and one with BP 5RF at Lan-2, two with BP 5RF at Lan-3, one with BP 5W and one with BP 3RF at Teg-1, one with BP 5W, two with BP 4W, two with BP 5, one with BP 5RF and one with BP 3RF at Teg-2, one with BP 5W, one with BP 4W, two with BP 5, one with BP 5RF and one with BP 4RF at Teg-3. *Zosterops senegalensis*: One with BP 5W and one with BP 5 at Lan-1. *Laniarius fuelleborni*: One with BP 5 mistnetted at Kim-5, one with BP 5 and one with BP 5W at Lan-1, one with BP 5W at Teg-1. *Cryptospiza reichenovii*: An individual was seen on a nest at Tegetero, 1330 m, on 6 December. One with BP 5RF and one with BP 4RF at Lan-3, one with BP 5RF at Teg-2, one with BP 5 at Teg-3. *Linurgus olivaceus*: One with BP 5S at Lan-3.

Juvenile birds were mistnetted only of *A. masukuensis* (one of 74 birds) and of *Nectarinia loveridgei* (five of 271 birds) (Table 5.6-7). Together with the list above of visual field observations of juvenile birds this shows that there were only few newly fledged birds when we visited the Ulugurus (although the list above is probably incomplete). Immature birds were mistnetted in more species (some immatures may have been overlooked in e.g. greenbuls though we attempted to check all individuals carefully) but this gives little information about the timing of the breeding season. Very few of the mistnetted individuals had vascularized brood patch but apart from that the amount of birds in breeding condition, determined by brood patch on mistnetted individuals, appeared to vary much between species. In the two most commonly mistnetted species, *Andropadus masukuensis* and *Nectarinia loveridgei*, we mistnetted several birds with wrinkled brood patches. In other commonly mistnetted species, e.g. *Alethe fuelleborni* and *Pogonocichla stellata*, only very few appeared to be in breeding condition. For many species the mistnet samples are too small to say anything. Most species are generally believed to start breeding at the onset of the early rains. The rains were much delayed in 1993 and did not really start before February 1994 although we experienced a few heavy rains and days with dark and moist/misty weather during the fieldwork. The delay of the rains may have led to a postponing of the breeding activities. However, no firm comparative evidence exists for this suggestion.

Appendix 5.12. Ornithology: On the methods applied and the completeness of our survey.

Below we briefly discuss the completeness of our ornithological survey in a miscellaneous way. We also comment briefly on our experience with the methods used during this survey in the hope that the notes can be of help for the planning of future surveys of African forests or for the production of a common manual for surveys. No complete manual for survey work and data analysis/presentation exists yet for Afromontane forest and it is therefore useful to leave miscellaneous notes on these issues though this report may not be the right forum. Numbers detected by the various methods are those from our three main localities only.

Mistnetting.

With this method we recorded 32 forest species and one non-forest species (*Bradypterus cinnamomeus*) (Kimhandu, Lanzi and Tegetero, excluding Kimboza data).

The 10 most commonly mistnetted species (standard mistnetting; totally 847 individuals) were: *Nectarinia loveridgei* (243 specimens), *Andropadus masukuensis* (65), *Pogonocichla stellata* (57), *Apalis thoracica* (45), *Cryptospiza reichenovii* (42), *Modulatrix stictigula* (39), *Phyllastrephus placidus* (33), *Alethe fuelleborni* (32), *Andropadus (t.) neumanni* (29) and *Trochocercus albonotatus* (28).

The mistnet captures are the only good indicator of the abundance of some very elusive understorey species. *Cryptospiza reichenovii* is one of these. It was mistnetted often at most stations but was rarely recorded by observational methods or tape recordings. Also for *Alethe fuelleborni* the abundance is much underestimated by observational methods and tape recordings. This shy ground bird sings very infrequently and rarely gives warning calls. Mistnetting was furthermore a good method to describe the relative abundance of other more easily recordable understorey species, such as robins and greenbuls. A noticeable exception is the common species *Bradypterus mariae* which moves near the ground through the herbaceous vegetation and seldom flies into the nets. This vocal species is the second most common in the plot data.

Species foraging in the mid and upper strata are not prone to fly into nets, unless the forest is very low and gnarled. The mistnet results underestimate the relative abundance of certain species moving between strata, e.g. *Trochocercus albonotatus* (most common above the height of mistnets), although it was caught at most stations.

The abundance of this vocal small flycatcher is much better described with the plot data. Other examples of discrepancy between mistnet and plot data are the above mentioned of *Bradypterus mariae* and the abundance figures for *Andropadus masukuensis* and *A. (t.) neumanni* at Kimhandu-3 (1940 m). These latter two species appear to be almost equally common judging from the mistnetting data whereas *A. (t.) neumanni* was recorded more than eight times as often as *masukuensis* during the plot assessments. The explanation is probably that *A. (t.) neumanni* is more vocal and more of an upper-strata species than *masukuensis*. For *Nectarinia loveridgei*, the relative abundance may be overestimated by mistnet data (compared to other species at the same stations) because it is very mobile and therefore very prone to fly into the nets. Mistnetting is ineffective where the forest is dry with the main insect activity being in the canopies as it appeared to be the case in Kimboza Forest during this survey (most species appeared to feed above 5 m where the insect activity was higher than in the dry forest floor).

The catch rate varied quite much between our stations, from 41.2 individuals per 2500 NMH at Tegetero-3 (1710 m) to 92.5 individuals per 2500 NMH at Kimhandu-1 (1520 m) (Table 5.8). It is interesting that the total number of species mistnetted was 15 at both these stations and that Kimhandu-1 is one of the stations with lowest average numbers of species per plot. The catch rate depends on a number of factors: general bird density, bird activity (dependent on e.g. the weather conditions, whether there are nestlings to feed or not, and how easy it is to fly fast through the vegetation), visibility of the nets (high visibility in case of sunny weather and open forest floor or no canopy cover, low visibility in case of dark forest and nearby vegetation) and dryness of the understorey (see above).

The number of species mistnetted generally stabilised some time during the second day (see Figure 5.4). For species-poor East African forests two days therefore seems to be a satisfactory minimum effort to put into the mistnetting with an effort of 2500 MNH = c. 100 m (if the nets are placed in different microhabitats and not in a long chain, same nets used both days). The number of individuals mistnetted per locality is quite small, however, and collected in a very small area. The data therefore gives only a very rough estimate and will not suffice for any robust statistical analysis between stations. J. Rabøl has demonstrated, using Monte Carlo simulations, that small samples give a false impression of a fairly constant species richness: samples of 50 birds drawn from three "communities", each with 1000 individuals and a "normal" species abundance curve but 40, 66 and 99 species (S), respectively gave: four simulation with S=40: 18, 21, 22 and 22 species; with S=66: 22, 25, 27 and 31 species; with S=99: 25, 25, 30 and 31 species (Fjeldså and Rabøl in press). However, mistnetting remains useful as the only kind of data that can be collected by students who are not fully familiar with identifying birds by jizz and calls.

Mistnet data are presented in two different ways in this chapter. In Figure 5.1 the abundance of the individual species are presented as per cent of the total capture at the single station. The per cent abundance of a given species cannot be compared between stations because the figure depends on the abundance of other species, e.g. of very common ones like *N. loveridgei* (example: catching three *Modulatrix stictigula* per MNH at two stations where there are 97 and 197 other birds will yield relative abundances of 3 and 1.5 % respectively). The figures given as "individuals mistnetted per 2500 MNH" in Table 5.8 should be easy to compare with coming surveys if the mistnetting is standardised, but the figures admittedly depend on the general catch rate at the station (which depends on a number of factors, see above). For assessing the species diversity per station it would probably be best to ensure that at least 100 individuals were mistnetted per station and then give the species diversity as number of species per first mistnetted 100 individuals. This number would be easy to compare with also for other studies.

During this survey almost every bird was measured. This restricted the number of nets we could handle. When the primary purpose is to obtain comparative community data, intentions to measure all birds will represent a bottleneck. We hope that the attitude towards ringing without measuring all birds will change in Tanzania. Another solution would be to involve more people in the mistnetting process but this is not always possible. Logistics was admittedly also sometimes the limiting factor in the sense that we put up as many nets as time allowed us to at many of the stations.

One-hectare plots.

With this method we recorded 55 forest species (plus *Schoutedenapus myioptilus* which we regard an aerial feeding forest species) and four non-forest species (*Chrysococcyx klaas*, *Bradypterus cinnamomeus*, *Laniarius aethiopicus* and *Dryoscopus cubla*) (Table 5.9).

The 10 most frequently recorded species on the totally 255 plots are *Nectarinia loveridgei* (180 plots), *Bradypterus mariae* (131), *Andropadus (t.) neumanni* (122), *Trochocercus albonotatus* (109), *Modulatrix stictigula* (97), *Pogoniulus leucomystax* (87), *Apalis thoracica* (87), *Pogonocichla stellata* (84), *Andropadus masukuensis* (65) and *Turdus olivaceus* (62).

For many species the plot data demonstrate trends which were also noted during general field observations. The method proved especially useful for describing the abundance of common birds foraging above the height of mistnets (e.g. *Tauraco livingstonii*, *Ceratogymna brevis*, *Columba arquatrix*, *Apaloderma vittatum*, *Pogoniulus leucomystax* and *Apalis chapini*) and of vocal understorey species (e.g. *Modulatrix stictigula* and *Bradypterus mariae*, both of which sing and give warning calls frequently). The plot data may to some extent underestimate the abundance of a very abundant species like *N. loveridgei* since we counted only constancy and not abundance per plot (for calculation of percentages in Table 5.1, five *N. loveridgei* on a plot counts the same as one individual on the plot). Of the single methods used on this survey, the one-hectare method is the most useful for rapid estimates of species richness and community composition.

The total number of species recorded per station depends not only on altitude and habitat complexity but also on the number of plots assessed. Due to time constraints (combined with often low bird activity), it was not possible to assess 25 plots at each station. The curves in Figure 5.4 show that the species accumulation has levelled out at stations where 22 or more plots were assessed (Kimhandu-2, -3 and -6; Tegetero-1, Tchenzema) and also at some stations where only around 15 plots were assessed (e.g. Kimhandu-4 and Lanzi-2). The best basis for a comparison is, however, still between stations with an equal effort and we advice future studies to allocate time for assessing 25 plots. On other stations it does not seem to have levelled out (e.g. at Kimhandu-1, Tegetero-2 and -3). Although the species accumulation has ceased, it remains to be tested to which extent the relative abundances of the species have stabilized after 25 plots and how the plot data correspond to absolute abundance measurements collected by territory mapping. Although 25 plots may provide a general characterisation of the community (the aim of making them), it is certainly not enough for recording the full assortment of low density species (like certain Threatened species) in the area. In very species-rich tropical forests like certain lowland forests in South America, the species accumulation would probably level out more slowly than in the Ulugurus and it would be necessary to assess much more than 25 plots.

The number of species recorded per plot varied much, also within the same stations (see Figure 5.4), e.g. at Tegetero-1 (1345 m) and Kimhandu-3 (1940 m) where the lowest number of species recorded at a single plot is four, the highest 16. Probably the numbers recorded at the plots have not declined from the first to the last plot assessed in the morning.

Tape recordings at dawn.

With this method we recorded 42 forest species (plus *Schoutedenapus myioptilus* which we regard an aerial feeding forest species) and one non-forest species (*Bradypterus cinnamomeus*).

Some of the species most often recorded at the stations are *Tauraco livingstonii*, *Modulatrix stictigula*, *Pogonocichla stellata* and *Turdus olivaceus*. Species with loud voices (e.g. *Tauraco livingstonii*) are often overrepresented on the recordings compared to species with less far-carrying voices, but if comparing only between stations and not with the results of other methods, this is not a problem.

The data generally support many of the trends that were obvious from mistnetting and plots. Furthermore it is the only of the standardised methods we used which is suitable for indicating the presence/non presence of species such as *Accipiter tachiro*, which generally vocalises only at dawn. The data sets are, however, very small and generally add little new information to the data obtained by mistnetting and one-hectare plots at the single stations. The tape recordings support the low number of species recorded at Kimhandu-5 (2520 m) in relation to other Kimhandu-stations but does not reflect the high number of species recorded by observational methods at the two lower Tegetero stations. The only example of a species whose presence at a station was revealed by tape recordings

only is the presence of *Camaroptera brachyura* at Tegetero-1 (1345 m). Using 45 minutes of recordings per day might have improved the results but this was not always possible due to technical problems.

The method demanded little work in the field but the data analysis was quite time consuming. We cannot recommend this method for obtaining standardised data sets on future surveys in the Eastern Arc. However, if the fieldworkers are inexperienced with the vocalisations when arriving to an area, tape recordings can certainly be of much value for later identification of species. In extremely species rich tropical forests like those of the Brazilian lowlands, tape recording is an indispensable part of a survey since, at present, only around two to three persons can identify most bird voices while in the field (J. Fjeldså pers. comm.).

General field observations.

60 forest species (plus *Schoutedenapus myoptilus* which we regard an aerial-feeding forest bird) were recorded at the three main localities. A further 11 non-forest species were recorded inside forest in these areas (Appendix 5.6). Species recorded only in the ecotone between forest and surrounding cultivation are not included in the figures above. We also recorded a number of overflying species (swallows, swifts, raptors etc., see Appendix 5.6).

Several of the Threatened species known from the Ulugurus occur at so low densities here and in other parts of the Eastern Arc Mountains that they are not normally detected by methods such as mistnetting and timed plot assessments. To determine the status of such species much time must be allocated to undertake general field observations, visiting also remote and different parts of the forest habitat and observing many mixed feeding parties if such are present. For low density species such as *Malaconotus alius* it is essential to search wide areas. To record *Apalis chariessa* (and probably *Ploceus nicolli* and some of the rare sunbirds) a large number of feeding parties must be studied.

During our survey we were under severe time pressure. Much time was used on mistnetting and one-hectare plot assessments. Also logistics (finding new camp sites, moving the large team, establishing campsites, putting up mistnets etc.) were very time consuming, although finding suitable campsites also means that considerable distances were walked with some bird watching being undertaken on the route (generally stops only when we heard or saw something interesting). Our survey of the status of Threatened species other than very audible and relatively common species like *Bathmocercus winifredae* can only be considered thorough in the relatively small areas we covered though we attempted to survey as much as time allowed us to. We would have liked to have more time to search for *M. alius* and other Threatened species in the Uluguru North FR, e.g. by examining more mixed feeding parties. The value of searching thoroughly for Threatened species to obtain a good impression of their abundance cannot be overemphasized since Red Data Book species are a key factor for the determination of the conservation value of a forested area. The time constraint furthermore meant that at Lanzi and Tegetero we did not survey the entire gradients. See also notes in Section 5.4.4 on the efforts of general field observations and in Appendix 2 on the background of the survey.

Conclusion. All methods are biased to an unknown degree, and robust hypothesis testing therefore requires more exact, time-consuming methods (spot-/territory-mapping). However, the circumstances require rapid surveys of eastern African forests (key areas have to be identified quickly to initiate conservation programmes in time), and in this situation standardised data give a better basis for evaluating variations in community structure than qualitative data. Therefore a combination of mistnetting, plots (and perhaps tape recording) as described here seems to be a suitable approach. Much time must be allocated to general field observations to determine abundance and habitat preferences of Threatened, Near-threatened and other restricted-range species.

Appendix 5.13. Further recommendations for future ornithological fieldwork.

Mountain forests. Some obvious "holes" in the range of habitats which we succeeded in describing during this survey are the lowest parts of the Uluguru North F.R. (below 1300 m), the highest parts of the Uluguru North F.R. (above 1710 m) and small forest lobes like Kasanga F.R. (at c. 1000 m) in the southern section.

The large Lukwangule Plateau has been visited only briefly and there may be taxa in this interesting area, which we are not aware of, such as montane cisticolas.

The taxonomic status of the very distinct endemic subspecies of Mountain Greenbul *Andropadus (t.) neumanni* needs further clarification. The southern satellite population of *Cryptospiza salvadorii* in the Ulugurus has not yet been assigned to subspecies. It is likely that it forms a separate, as yet undescribed, subspecies, but it is necessary to collect additional specimens to determine whether this is the case.

Lowland forests. It is important to take seasonal vertical migration into consideration when planning conservation initiatives in the Eastern Arc. The importance of lowland forests as dry season refuges for maintaining the populations of montane breeding species must not be forgotten, though the extent of the migration is still unknown. If these refuges are clearfelled or partly destroyed, it may affect also part of the submontane and montane avifaunas. Loss of forest on lower slopes and foothills may already have had an effect on the populations of species carrying out vertical migration in the Ulugurus.

Kimboza and Ruvu F.R.s are easily accessible from Dar es Salaam and would be a fine study site for Tanzanian students of biology to carry out standardised work on seasonal fluctuations in the habitat distribution of birds (for a discussion of these, see Appendix 5.8). Such a study could reveal whether the lowland forests are an important dry season refuge for populations of montane species. Additional small patches of forest in the lowland and some rich woodland areas should be visited at least briefly to check whether these types of habitat are of importance for montane species (the Andersen records of *Pogonocichla stellata* from the Ngerengere River indicate that this thrush may use a wide range of off-season habitats and it seems unlikely that the whole Uluguru population of *P. stellata*, if migratory, should depend solely on the relatively small areas of lowland forest. In addition, *Terpsiphone viridis* may move to woodlands in the cold season). Such visits to small lowland forest patches and rich woodlands (both habitat types are very threatened in the Ulugurus) would also determine whether these habitat types are of importance for the Near-threatened species *Anthreptes neglectus* and *Circaetus fasciolatus*.

Appendix 8 (Botany)

Appendix 8.1. Further discussion of data from Tables 8.2 and 8.3

The basal area (BA) of upper montane forest (altitude above 1800 m) normally lies between 30 and 70 m²/ha (Lovett 1993a). Three of the plots in the upper montane forest (Kimhandu-4 [2145 m], Lanzi-2 [1940 m] and Lanzi-3 [2120 m]) have very large total basal area. The comparatively lower basal area at Kimhandu-5 (2520 m) should be seen in the light that bamboos (very prominent) are not included. The BA of montane forest (altitude 1200-1800 m) normally lies between 30 and 120 m²/ha. The Kimhandu-1 (1520 m) plot has a BA of 141.57 m²/ha. The BA's of other plots lie within normal range.

According to the Spearman rank correlation coefficient using a significance level of 5% there were no correlations between the total number of stems and total BA of the plots. A positive correlation between number of individuals and number of species was found using a significant level of 5%.

The Simpson index shows a maximum diversity at the plots at Kimhandu-3 (1940 m) and Lanzi-2 (1920 m) with a very high value for the Lanzi-2 (1920 m) plot. The Shannon index also has its maximum at the Lanzi-2 (1920 m) plot but at Kimhandu it is Kamhandu-2 (1710 m) station that has the highest value. This is a result of the Shannon index being biased towards species richness, the Kimhandu-2 (1720 m) plot having the highest number of species (34 species) and the Simpson index being biased towards evenness, the plots Kimhandu-3 (1940 m) and Lanzi-2 (1920 m) having the highest equitability.