SOME ENDEMIC BUTTERFLIES OF EASTERN AFRICA AND MALAWI

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Abstract: The 'Eastern Arc' of Kenya and Tanzania is defined in terms of its butterfly fauna. Butterflies endemic to it and neighbouring ecological zones are listed. The 'Tanzania-Malawi Highlands' are identified as an ecological zone. Distributions of the endemic butterflies within the Eastern Arc and other zones are examined. Some possible causes of endemism are suggested. Conservation issues are discussed. An updated list of the endemic Butterflies of Tanzania is given.

Key words and phrases: Endemism, biodiversity, conservation, ecological zones, East African Coastal Belt, Eastern Arc Mountains, Tanzania-Malawi Highlands.

Introduction

The Study Area includes the whole of Tanzania, with extensions to include coastal Kenya and the highlands of Malawi. Ecological zones within the study area are identified. Butterflies endemic within the study area are listed by zone, and distributions within two of the zones are examined in detail. The conservation status of important forests is discussed and the most vulnerable areas are identified. In the Appendix (I) we provide an updated checklist of Tanzania's endemic species.

Methods and Materials

Ecological zones are defined. The species endemic to each zone are listed, together with their distribution within the zone and altitude range within which they are known to occur (Table 1): totals are given.

In the discussion section zonal endemism is examined. Species endemic to individual mountain blocks are scheduled in Table 2 and totals are given. Conservation priorities are discussed.

The number of species each block shares with each other block is tabulated (Table 3) together with the total of species so shared present on each block. Shared endemics of the Udzungwa Mountains are analysed (Table 4). Table 5 shows the number of coastal, Arc and Tanzania-Malawi Highland species present in each of the main blocks.

Map 1 shows the Eastern Arc Mountains of Kenya and Tanzania and the Tanzania-Malawi Highlands, as defined in this paper. In Appendix I, butterflies endemic to Tanzania are listed (Table 6), together with notes on their distribution and altitude range. Species no longer considered to be endemic (Congdon and Collins 1998, Appendix IV) are tabulated (Table 7) and the reason for their removal from the endemic list is indicated.

ECOLOGICAL ZONES

The **East African Coastal Belt**. This comprises the Zanzibar-Inhambane mosaic vegetation zone, including the off-shore islands, as far south as the Ruvuma River. It is bordered to the north by the dry Somali-Masai zone, and inland by higher ground, not least by the Arc. Some of the butterflies of this zone are also found in the lower levels of the Eastern Arc, but in practice the separation between the two is usually quite clear cut*. For the purposes of this study, species occurring in forests away from the foothills of the Eastern Arc Mountains are taken to be coastal, even if they also occur in the Arc forests, while those that have not been found to stray away from the Arc forests are defined as Eastern Arc butterflies.

Lovett's **Eastern Arc Mountains** of Kenya and Tanzania run from the Teita Hills in south east Kenya to the western end of the Udzungwa Mountains of southern Tanzania. (Map 1) They are a series of ancient, forested crystalline formations, separated from each other by lower, dry country, and from the forests of the Congo Basin by a wide belt of arid country. The forested eastern faces of these mountains have been bathed in moist air from the Indian Ocean (the SE Trade Winds) since the break-up of Gondwanaland about 130 mybp.** Alternating wet and dry periods (pluvials and interpluvials) have led to colonisation followed by isolation and hence speciation on the separate mountain masses, to the extent that some biologists have compared the Eastern Arc with the Galapagos Islands. The Eastern Arc is recognised as one of the world's more important centres of biodiversity.

The **Tanzania-Malawi Highlands**. Moreau's Tanganyika-Nyassa Montane Chain runs from the Usambaras to Mlanje Mt in Malawi, and therefore includes virtually the whole of the Eastern Arc. We suggest that an examination of the distribution data justifies the separation of the rich east facing Arc mountains from the higher, colder and somewhat drier forests on the tops, which are of undifferentiated Afromontane vegetation (White 1983). These forests are found on the tops of the Arc mountains, and on the Rubehos, the Southern Highlands, and the mountains of Malawi, including the Nyika Plateau. The T-M Highlands are bordered to the south by the biogeographical barrier of the Zambezi valley. The forests of the Rukwa Escarpment belong here and are included. Highland areas of south western Congo Kinshasa and Zambia also belong in this zone, but have been little collected. The data support the separation from the Eastern Arc of several mountains considered by some authors to be a part of it. Thus the Rubehos are more closely associated with the Tanzania-Malawi Highlands, as are the Southern Highlands. The Pare Mountains are at least as close to the T-M Highlands as they are to the Arc. These aspects are discussed below.

*The exception is *Epamera mermis*, a coastal species from S.E. Kenya to the Rondo Plateau, but which also occurs in the Eastern Arc, inland to Lulanda Forest in the Udzungwas.

**Or since they were elevated by block faulting ca. 20mybp?????

The ***Brachystegia* Zone**. This is the area of Zambesian vegetation west and south of the dry central plain of Tanzania, bordered to the south by the westerly sweep of the Arc. It starts around Biharamulo, and includes Kigoma and Mpanda, the highlands of Ufipa with the Rukwa Rift, and the belt of woodland running from Mbeya to Iringa.

There is also *Brachystegia* woodland south from the Southern Highlands to Songea, but these areas have been little studied.

The **Western Forests**. These are the forests on the eastern shore of L Tanganyika, draining into the Lake, the Congo river, and thence into the Atlantic, but separated from the bulk of the Guineo-Congolean forests by the Lake. The forests of north west Tanzania, at Minziro, although rich in butterflies, are essentially part of the Lake Victoria (and Mediterranean) drainage basin, and are not considered here. Several species described from Minziro and not so far recorded from Uganda are assumed to be present in that country. They are therefore not included in the list of Tanzania endemic species (Appendix I).

Butterflies endemic to each Ecological Zone are listed below (Table 1).

TABLE 1. ZONAL ENDEMISM

Key to Distributions

1	Northern Highlands including the Crater Highlands
2	Kilimanjaro
3	Pare Mts
4	Eastern Kenya - Teita Hills, Kenya Coastal
5	Tanzania Coastal
6	Usambaras
7	Nguru - including N. Nguru or Nguu
8	Uluguru
9	Udzungwa
10	Rubeho
11	Southern Highlands
12	Northern Malawi, Vipya, Nyika to Misuku
13	Southern Malawi, Zomba, Mlanje
14	The dry sides of 9,11
15	Ufipa to Biharamulo
16	Matengo Hills, Songea
17	Offshore Islands

Altitude

1	0 - 400m	( ) = occasionally
2	400 - 800m	? = Uncertain - based on Kielland's (1990) text
3	800 -1200m	
4	1200-1600m	
5	1600-2000m	
6	2000m+	

COASTAL BELT

	Distribution	Altitude
Celaenorrhinus kimboza Evans 1949	8	1
Ampittia parva Aurivillius 1925	2,5,6,7,8,9,16	1-3
Gorgyra diva Evans 1937	4,5,7,8	1-4
Graphium kirbyi Hewitson 1872	4,5,6,7,8	1,2
Mylothris talboti Berger 1980	5,7,8,9	1-3(4)
Bicyclus kiellandi Condamin 1986	5,9	2-4
Physcaeneura jacksoni Carcasson 1961	3,7,9,10,16	1-4
Coenyropsis carcassoni Kielland 1976	4,5	1-3
Charaxes pembanus Jordan 1925	17	1
Charaxes contrarius van Someren 1969	4,5,6,7,8,9	1,2
Charaxes lasti Grose-Smith 1889	4,5,6,7,8	1,2
Pseudathyma lucretioides Carpenter & Jackson 1950	4,5	1,2
Neptis rogersi Eltringham 1921	4,5	1
Hypolimnas usambara Ward 1872	4,5,6,7,8,9	1-3
Acraea aubyni Eltringham 1912	4,?5	1,2
Pentila rogersi Druce 1907	4,5	1,2
Teriomima micra Grose-Smith 1898	4,6	1-3
Teriomima subpunctata Kirby 1887	4,5,6,7,8,9	1-3
Baliochila amanica Stempffer & Bennett 1953	4,5,6,7,8,9	1-3
Baliochila latimarginata Hawker-Smith 1933	4,5,6,8,9	1,2
Baliochila minima Hawker-Smith 1933	4,5	1,2
Baliochila stygia Talbot 1937	4,5,?17	1,2
Eresinopsides bichroma Strand 1911	4,5,6,7,8	1-3
Aslauga orientalis Cottrell 1981	4,5	1,2
Axiocerses collinsi Henning & Henning 1996	4	1-3
Pentila rondo Kielland 1990	5	3
Baliochila lequeuxi Kielland 1994	17	1
Deloneura abri Congdon & Collins 1998	17	1
Axiocerses styx Rebel 1905	5,7,8	1,2
Epamera mermis Druce 1896	4,5,6,8,9	1-4
Triclema kimboza Kielland 1990	4,8	1,2
Abisara zanzibarica Collins 1990	17	1

Total 32

EASTERN ARC

Celaenorrhinus cordeironis Kielland 1992	6	3
Celaenorrhinus sanjeensis Kielland 1990	9	2
Celaenorrhinus uluguru Kielland 1990	8	4,5
Astictopterus tura Evans 1951	7,9	1-4
Ceratrichia bonga Evans 1947	6,8	2,3
Artitropa usambarae Congdon, Kielland & Collins 1998	6	3
Mylothris pluviata Berger 1980	7	3-6
Mylothris superbus Kielland 1985	7,9	3,4
Acraea (Acraea) adrasta Weymer 1892	4,6,8,9	1-3

Acraea (*Acraea*) *bergeriana* Pierre 1979	8,9	1-6
Acraea (*Acraea*) *punctimarginea* Pinhey 1956	6,8	1
Acraea (*Acraea*) *rohlfsi* Suffert 1904	6	3,4
Acraea (*Actinote*) *vuilloti* Mabille 1889	6,7,8,9,10	3-6
Bicyclus danckelmani Rogenhofer 1891	6,7,9,10	3,4(5)
Neocoenyra jordani Rebel 1906	7	3,4
Hypolimnas antevorta Distant 1880	6	3
Sallya pseudotrimeni Kielland 1985	5,8,9	3,4(5)
Cymothoe amaniensis Rydon 1980	6	3
Cymothoe aurivillii Staudinger 1899	7,8,9,10	(3)4-6
Cymothoe teita van Someren 1939	4	2-4
Neptis nina Staudinger 1896	4,5,6,7,8,9,10	1-6
Pseudathyma abri	7	4
Charaxes lucyae van Someren 1975	6,7,9	3-5
Charaxes mccleeryi van Someren 1972	8,9	2-6
Charaxes phenix Lequeux and Turlin 1993	7,9	3
Charaxes usambarae van Someren & Jackson 1952	6,7	3-5(6)
Alaena johanna Sharpe 1890	4,9,14	3,4
Ornipholidotos nguru Kielland 1987	7	4
Mimacraea gelinia Oberthur 1893	6,7	3,4
Baliochila congdoni Kielland 1990	7	4
Baliochila nguru Kielland 1986	7	4
Baliochila pringlei Stempffer 1967	6	3
Baliochila sp nr *pringlei*	9	3
Baliochila warrengashi Collins and Larsen 1996	6	3
Baliochila sp nov (1)	9	3
Baliochila sp nov (2)	9	3
Baliochila sp nov (3)	8	4
Aslauga tanga Libert and Collins 1997	6,7	3,4
Lachnocnema unicolor Libert 1996	7	4
Capys usambarae Congdon & Collins 1998	6	3
Axiocerses kiellandi Henning and Henning 1996	9	3,4
Etesiolaus pinheyi Kielland 1986	6,8	1-3
Virachola vansomereni Stempffer 1951	4,6	3-5 *Pilodeudorix*
nr *zela* Hewitson 1869	9	3

Eastern Arc Subtotal 43

High altitude species, which are essentially Tanzania-Malawi Highlands butterflies, but which occur on the tops of Eastern Arc Mountains.

Metisella congdoni de Jong and Kielland 1983	9,11	(4)5
Metisella sp. (aff *medea*)	9,11	6?
Chondrolepis obscurior de Jong 1986	9,11	5,6
Chondrolepis similis de Jong 1986	9	4-6
Papilio pelodurus Butler 1895	6,7,8,9,10,11,12,13	(1)2-5
Mylothris crawshayi Butler 1896	8,9,10,11,12	4-6
Mylothris kiellandi Berger 1985	6	5,6
Bicyclus pareensis	3	5
Bicyclus simulacris Kielland 1990	8,9,10,11,12	(3)4-6
Bicyclus uzungwensis Kielland 1990	9,10	5,6
Neocoenyra fulleborni Thurau 1903	9,11,16	3,4(5)

Neocoenyra heckmanni Thurau 1903	9,10,11,16	(4)5,6
Neocoenyra parallelopupillata Karsch 1897	6	6
Charaxes congdoni Collins 1989	9,11,16	5,6
Cymothoe magambae Rydon 1980	3,6	5,6
Pseudathyma uluguru Kielland 1985	8	6
Neptis incongrua Butler 1896	8,9,10,11,12,13,16	4-6
Spindasis collinsi Kielland 1980	6	5,6
Epamera congdoni Kielland 1985	8,9,10,11,12	5,6
Epamera dubiosa Stempffer & Bennett 1959	6,7,9,10,12	5,6
Pilodeudorix rodgersi Kielland 1985	7,8,9,10	5,6
Anthene montana Kielland 1990	8	5,6
Anthene sp. nr *montana* (Magamba)	6	5
Anthene uzungwae Kielland 1990	9,11	5,6
Triclema nr *nigeriae* Aurivillius 1905	9	5
Uranothauma cuneatum Tite 1958	7,8,9,10,11,12	5,6
Uranothauma lukwangule Kielland 1987	8	6
Uranothauma nguru Kielland 1985	7	6
Uranothauma uganda Kielland 1980	8	5,6
Uranothauma usambarae Kielland 1980	6	5,6
Uranothauma williamsi Carcasson 1961	6,7,8,9,10,11,12	4-6
Harpendyreus berger Stempffer 1976	8	6
Tuxentius ertli Aurivillius 1907	6,7,9,10,11,12,13,16	3-6
Lepidochrysops kennethi Kielland 1986	9	5

Subtotal shared with T-M Highlands 35

Total of endemic species on the Eastern Arc 78

TANZANIA - MALAWI HIGHLANDS

Celaenorrhinus rubeho Kielland 1990	10	5
Abantis arctomarginata Lathy 1901	9,11,12,13	4
Metisella congdoni de Jong and Kielland 1983	9,11	(4),5
Metisella decipiens Butler 1896	9,11,12,16	3-5
Metisella perexcellens Butler 1896	12,15	5,6
Metisella sp. (aff *willemi*)	10	5
Metisella sp. (aff *medea*)	9,11	6?
Chondrolepis obscurior de Jong 1986	9,11	5,6
Chondrolepis similis de Jong 1986	9	4,5
Papilio pelodurus Butler 1895	6,7,8,9,10,11,12,13	(1)2-5
Papilio thuraui Karsch 1900*	9,11,12	4-6
Papilio ufipa Carcasson 1961	15	3-6
Mylothris crawshayi Butler 1896	8,9,10,11,12	4-6
Mylothris kiellandi Berger 1985	6	5,6
Bematistes scalivittata Butler 1896	9,10,11,12,15	5,6
Bicyclus pareensis	3	5
Bicyclus simulacris Kielland 1990	8,9,10,11,12	(3)4-6
Bicyclus uzungwensis Kielland 1990	9,10	5,6
Neocoenyra fuligo Kielland 1990	10	6
Neocoenyra fulleborni Thurau 1903	9,11,16	3,4(5)
Neocoenyra heckmanni Thurau 1903	9,10,11,16	(4)5,6

Neocoenyra mittoni	11	6
Neocoenyra parallelopupillata Karsch 1897	6	6
Neocoenyra petersi Kielland 1990	11	6
Charaxes chunguensis White and Grant 1986	10	5,6
Charaxes congdoni Collins 1989	9,11,16	5,6
Charaxes dowsetti Henning 1989	12	6
Charaxes margaretae Rydon 1989	13	3
Charaxes nyikensis van Someren 1975	12	6
Cymothoe cottrelli Rydon 1980	11,12	5,6
Cymothoe magambae Rydon 1980	3,6	5,6
Cymothoe melanjae Bethune-Baker 1926	13	4-6
Cymothoe zombana Bethune-Baker 1926	13	5
Pseudathyma uluguru Kielland 1985	8	6
Neptis incongrua Butler 1896	8,9,10,11,12,13,16	4-6
Alaena sp nr *reticulata* Butler 1896	12	6
Alaena ochracea Gifford 1965	13	5,6
Alaena lamborni Gifford 1965	13	4
Spindasis collinsi Kielland 1980	6	5,6
Axiocerses nyika Henning & Henning 1996	12	5,6
Axiocerses bamptoni Henning & Henning 1996	13	5
Epamera congdoni Kielland 1985	8,9,10,11,12	5,6
Epamera dubiosa Stempffer & Bennett 1959	6,7,9,10,12	5,6
Epamera helenae Henning & Henning	12	6
Argiolaus sp. nr *crawshayi* (Mbisi)	15	5,6
Argiolaus stewarti Heath 1985	12	5,6
Pilodeudorix rodgersi Kielland 1985	7,8,9,10	5,6
Virachola magda Gifford 1963	9,10,12,13	4,5
Virachola montana Kielland 1985	9,12	3-6
Harpendyreus hazelae Stempffer 1973	12	4
Anthene montana Kielland 1990	8	5,6
Anthene sp nr *montana*	6	5
Anthene uzungwae Kielland 1990	9,11	5,6
Anthene sp nr *uzungwae* Kielland 1990	12	4?
Triclema nr *nigeriae* Aurivillius 1905	9	5
Uranothauma confusa Kielland 1989	13	6
Uranothauma crawshayi Butler 1895	9,11,12	5,6
Uranothauma cuneatum Tite 1958	7,8,9,10,11,12	5,6
Uranothauma lukwangule Kielland 1987	8	6
Uranothauma nguru Kielland 1985	7	6
Uranothauma uganda Kielland 1980	8	5,6
Uranothauma usambarae Kielland 1980	6	5,6
Uranothauma williamsi Carcasson 1961	6,7,8,9,10,11,12	4-6
Harpendyreus berger Stempffer 1976	8	6
Harpendyreus hazelae Stempffer 1973	12	5
Harpenyreus juno Butler 1895	11,12,15	4-6
Tuxentius ertli Aurivillius 1907	6,7,9,10,11,12,13,16	3-6
Euchrysops unigemmata Butler 1895	9,12	5,6
Lepidochrysops kennethi Kielland 1986	9	5
Lepidochrysops nyika Tite 1961	12	5,6

Total 69 (includes 35 on tops of E Arc Mountains)

**Sensu* Kielland 1990

BRACHYSTEGIA ZONE

Metisella carsoni Butler 1898	15	4-6
Platylesches larseni Kielland 1992	15	3,4
Physcaeneura robertsi Kielland 1990	15	4?
Bicyclus tanzanicus Condamin 1986	15	4-6
Neocoenyra pinheyi Carcasson 1961	14	4
Alaena bicolora Bethune-Baker 1924	14	2,3
Alaena bjornstadi Kielland 1993	15	4
Alaena ferrulineata Hawker-Smith 1933	15	3-5
Alaena kiellandi Carcasson 1965	15	3-5
Alaena madibirensis Wichgraf 1921	14,15	4
Alaena sp. nov (Iringa)	14	5
Lachnocnema inexpectata Libert 1996	15	3
Lachnocnema tanzaniensis Libert 1996	11,15,16	3-5
Spindasis tanganyikae Kielland 1990	15	3-5
Epamera bamptoni Congdon & Collins 1998	14	3,4
Argiolaus montana Kielland 1978	15	4-6
Stugeta mimetica Aurivillius 1916	14	4
Capys sp. n	7,15	4-6
Anthene madibirensis Wichgraf 1921	14	4
Anthene mpanda Kielland 1990	14,15	4,5?
Lepidochrysops carsoni Butler 1901	15? Fwambo	?
Lepidochrysops chala Kielland 1980	15	6
Lepidochrysops mpanda Tite 1961	15	5

Total 23

WESTERN FORESTS

Andronymus bjornstadi Congdon, Kielland & Collins 1998	15	3
Bicyclus mahale Congdon, Kielland & Collins 1998	15	2,3
Bicyclus similis Condamin 1986	15	5,6
Euryphura kiellandi Hecq 1989	15	3,4
Euphaedra confina Hecq 1992	15	4
Charaxes grahamei van Someren 1969	15	3,4
Ornipholidotos tanganyikae Kielland 1983	15	3,4
Cephetola tanzaniensis Libert 1999	15	3,4

Total 8

SUMMARY OF ZONAL TOTALS

Coastal	32
Eastern Arc	78 - includes 35 T-M Highlands species
Tanzania-Malawi Highlands	69 - includes 35 on E Arc Mountains
Brachystegia Zone	23
Western forests	8

Two species not included in the above are worthy of mention.
Neptis aurivillii Schultze 1913 is found from the Teita Hills to southern Malawi, and therefore occupies the whole of Moreau's Tanganyika-Nyassa Montane Chain.
Issoria smaragdifera Butler 1895 is essentially a T-M Highland butterfly, but has managed to cross the Zambezi into the highlands of eastern Zimbabwe.

DISCUSSION

The relatively large number of endemic species in the Coastal Belt is surprising, given the apparent uniformity of the terrain and climate. They do not appear to be direct vicariants of western butterflies, nor are they obviously descended from nearby montane stock. Possibly the answer lies in great antiquity. As an indication of this, three genera, *Teriomima*, *Eresinopsides* and *Baliochila* appear to be virtually endemic to the East African coast, in the last case having spread inland.

Endemism in the Arc has already been discussed. The high numbers of endemic species should be no cause for surprise, given the age and isolation of the environment, and the biological richness of the forests. The importance attached to conservation measures in these forests is fully justified.

The relative poverty of the western forests in terms of endemic species, indicates that Lake Tanganyika does not constitute a very effective barrier to butterfly movement.

The large number of Afromontane (Tanzania-Malawi Highland) endemics may be accounted for by much the same factors as apply to the Arc. The mountains of the T-M Highlands are at least as old as the Rift Valley, some 20 million years. Endemism in the forests is to some extent augmented by some speciation in the highland grasslands (e.g. *Euchrysops unigemmata*, *Lepidochrysops nyika*). The genus *Uranothauma* may well have arisen at high levels in these mountains. Kielland (1990) points out that of the 20 known species of *Uranothauma*, 19* occur in Tanzania. Eight of these are T-M Highlands endemics. Congdon and de Jong (1993) compare the Arc butterfly fauna with that of the highlands of the Western Rift, so it would be instructive to make a similar comparison between the T-M Highland fauna and that of the Kenya Highlands, including their extensions into Uganda (Mt Elgon) and northern Tanzania (Crater Highlands, Kilimanjaro). In this context Blundell (1987) remarks that all 17 genera and 166 species of East African Orchideae are found in the Southern Highlands of Tanzania, compared with only eighty species in eleven genera in the Kenya Highlands.

The broad belt of Zambesian *Brachystegia* woodland which stretches across Africa from Angola, ends in Tanzania. To the north it is blocked by the lush Lake Victoria regional mosaic, the Kenya Highlands, the dry plains of Serengeti, and the intrusion of dry Somali grasslands in the Masai Steppe, which gives way to dry, thorn country further south towards Iringa. From the Mbeya Gap eastwards the *Brachystegia* clings to the north slopes of the Southern Highlands and the Udzungwas, ending in the western foothills of the Rubehos. Thus in Tanzania the *Brachystegia* occupies an arc, southwards from Biharamulo to Mbeya, and eastwards to Iringa. The topography is varied, and the vegetation somewhat fragmented, in contrast to the bulk of the *Brachystegia* belt further

west. The relatively large number of species endemic to this zone may to some extent be the result of peripheral fragmentation, but also reflects the sheer size of the area.

The butterfly fauna of the forested valleys on the eastern side of Lake Tanganyika is very different from that of eastern Tanzania, and has more in common with the Guineao-Congolean forests to the west. The forests are small and fragmented. Two of the eight endemic butterfly species are known from the Mahale Mountains National Park, but the remainder are vulnerable. Their forests are unprotected and are being cleared for cultivation. Recent events outside Tanzania have only served to increase this pressure, as refugees continue to flood into the area.

*18 if, as we believe, *U. confusa* is confined to southern Malawi.

Table 2. Endemism: From the Teita Hills to Mlanje Mountain

Species so far found only in or at the foot of one mountain block are scheduled below. Totals are shown in parenthesis.

Teita Hills

Cymothoe teita van Someren 1939
(1)

Pare Mts

Bicyclus pareensis
(1)

Usambara

Celaenorrhinus cordeironis Kielland 1992
Artitropa usambarae Congdon, Kielland & Collins 1998

Mylothris kiellandi Berger 1985

Acraea (*Acraea*) *rohlfsi* Suffert 1904

Neocoenyra parallelopupillata Karsch 1897

Hypolimnas antevorta Distant 1880
Cymothoe amaniensis Rydon 1980

Baliochila pringlei Stempffer 1967
Baliochila warrengashi Collins and Larsen 1996

Spindasis collinsi Kielland 1980
Capys usambarae Congdon & Collins 1998
Anthene sp. nr *uzungwae* (Magamba)
Uranothauma usambarae Kielland 1980
(13)

Nguru

Neocoenyra jordani Rebel 1906

Pseudathyma abri

Ornipholidotos nguru Kielland 1987
Baliochila congdoni Kielland 1990
Baliochila nguru Kielland 1986
Lachnocnema unicolor Libert 1996
Uranothauma nguru Kielland 1985
(7)

Uluguru

Celaenorrhinus kimboza Evans 1949
Celaenorrhinus uluguru Kielland 1990

Pseudathyma uluguru Kielland 1985

Harpendyreus berger Stempffer 1976
Anthene montana Kielland 1990
Uranothauma lukwangule Kielland 1987
Uranothauma uganda Kielland 1980
(7)

Udzungwa

Celaenorrhinus sanjeensis Kielland 1990
Chondrolepis similis de Jong 1986

Baliochila sp nov (1)
Baliochila sp nov (2)
Baliochila sp nr *pringlei*

Axiocerses kiellandi Henning and Henning 1996
Pilodeudorix nr *zela* Hewitson 1869
Triclema nr *nigeriae* Aurivillius 1905
Lepidochrysops kennethi Kielland 1986
(9)

Rubeho

Celaenorrhinus rubeho Kielland 1990
Metisella sp. aff *willemi*

Neocoenyra fuligo Kielland 1990

Charaxes chunguensis White and Grant 1986
(4)

Southern Highlands

Neocoenyra mittoni Pinhey 1956
Neocoenyra petersi Kielland 1990
(2)

Northern Malawi, Nyika, Misuku

Charaxes dowsetti Henning 1989
Charaxes nyikensis van Someren 1975

Alaena sp nr *reticulata* Butler 1896
Axiocerses nyika Henning & Henning 1996
Epamera helenae Henning & Henning 1989
Argiolaus stewarti Heath 1985
Harpendyreus hazelae Stempffer 1973
Anthene sp nr *uzungwae* Kielland 1990
Lepidochrysops nyika Tite 1961
(9)

Southern Malawi, Zomba, Mlanje

Charaxes margaretae Rydon 1989
Cymothoe melanjae Bethune-Baker 1926
Cymothoe zombana Bethune-Baker 1926

Alaena ochracea Gifford 1965
Alaena lamborni Gifford 1965
Axiocerses bamptoni Henning & Henning 1996
Uranothauma confusa Kielland 1989
(7)

SHARED ENDEMICS

Following on from the schedule of distributions of endemic species, Table I, above, a reassessment of affinities becomes possible, based on the numbers of species each block shares with other blocks. Note that not all Tanzania (or Malawi) endemic species appear in this analysis, as they are either not present in the areas studied, or they are not present on more than one mountain block.

In Table 3, below, we show the number of species every block shares with each of the others, and the total number of shared endemics on each block.

Table 3. Shared Endemics

Column Headings

N	Northern Highlands (Crater Highlands, Mt Meru, etc.)	R	Rubeho Mts
Kj	Kilimanjaro	H	Southern Highlands (Rungwe, etc.)
P	Pare Mts	Nk	Northern Malawi (Vipya, Nyika, Masuku, etc.)
Kc	Kenya Coast (inc. Teita Hills)	Mj	Southern Malawi (Zomba, Mlanje)
Tc	Tanzania Coast	D	Dry Southern Highlands
S	Usambara Mts	W	Western Tanzania
G	Nguru Mts	M	Matengo Hills
L	Uluguru Mts	I	Offshore Islands
Z	Udzungwa Range		

Total of shared endemics on a particular block in **bold**. E. g. the Ulugurus have 31 species in common with other blocks. The inner square encloses the core blocks of the Coastal, Arc and T-M Highland zones.

	N	Kj	P		Kc	Tc	S	G	L	Z	R	H	Nk		Mj	D	W	M	I
N	**3**	1		**0**				1		1	1	1		**0**					
Kj	1	**2**		**0**		1	1	1	1	1				**0**				1	
P			**2**	**0**			1	1		1	1			**0**				1	
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Kc				**0**	**25**	19	15	9	12	9	1			**0**		1			1
Tc		1		**0**	19	**25**	11	13	15	12	2			**0**				2	1
S		1	1	**0**	15	11	**28**	20	17	17	8	3	4	**0**	2			3	
G	1	1	1	**0**	9	11	20	**30**	18	22	11	4	5	**0**	2		1	3	
L		1		**0**	12	15	17	18	**31**	23	11	7	7	**0**	2			2	
Z	1	1	1	**0**	9	12	17	22	23	**50**	20	21	17	**0**	5	1	1	8	
R	1		1	**0**	1	2	8	11	11	20	**20**	11	11	**0**	4		1	4	
H	1			**0**			3	4	7	21	11	**24**	15	**0**	4		4	8	
Nk				**0**			4	5	7	17	11	15	**20**	**0**	5		3	3	
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Mj				**0**			2	2	2	5	4	4	5	**0**	**5**			2	
D				**0**	1					1				**0**		**2**	2		
W				**0**				1		1	1	4	3	**0**		2	**7**	1	
M		1	1	**0**		2	3	3	2	8	4	8	3	**0**	2		1	**9**	
I				**0**	1	1								**0**					**1**

The **Pare Mountains** do not appear to be particularly species rich, having only one endemic species and two in common with other Eastern Arc mountains, perhaps due to their lack of east facing lowland forest.

The **Rubeho Mountains** are evidently part of the T-M highlands, and are now placed in that zone. They are only separated from the Udzungwas by the Ruaha Gorge, so it is not surprising that of the 20 shared endemics on the Rubehos, all are found in the Udzungwas. The majority of these are T-M Highland butterflies.

The **Udzungwas** are pivotal. Their affinities with the coastal fauna are as strong as those of the other Arc mountains, which is surprising given their distance inland from the coast. The commonality between all four of the major Arc mountain blocks is uniformly strong. However the Udzungwas have as many species in common with the Southern Highlands (and northern Malawi) as with the Arc. These are different faunas. This is shown quite

clearly in Table 4, below. The Southern Highlands have relatively few species in common with the other Arc mountains, and none in common with the coast, but the commonality between the four main blocks of the T-M Highlands is as marked as in the case of the Arc.

There is a sharp drop in commonality between the mountains of northern and southern **Malawi**. This might in part result from the exclusion from this study of species these blocks may have in common with the highlands of eastern Zimbabwe, but more probably reflects species poverty in southern Malawi .

Table 4. Udzungwa Mountains Shared Species

Species from the Coastal Belt, Eastern Arc and Tanzania-Malawi Highlands only, and treating the Rubeho Mts as part of the Udzungwa. Example: there are 5 species present on all blocks from Kenya coastal to Udzungwa, two species with similar distributions but absent from the Ngurus.

Kc	Tc	S	G	L	Z	H	Nk	Mj	M
5	5	5	5	5	**5**				
2	2	2		2	**2**				
1		1		1	**1**				
1					**1**				
	1		1	1	**1**				
	1				**1**				
		1	1	1	**1**				
		3	3		**3**				
			3		**3**				
			2	2	**2**				
				2	**2**				
8	**8**	**11**	**15**	**14**	**22**				
		1	1	1	**1**	1	1	1	
		1	1		**1**		1		
		1	1	1	**1**	1	1		
		1	1		**1**	1	1	1	1
			1	1	**1**	1	1		
				3	**3**	3	3		
				1	**1**	1	1	1	1
		4	**5**	**7**	**9**	**8**	**9**	**3**	**2**
					4	4			
					3	3	3		
					1	1	1	1	
					1	1	1		1
					3	3			3
					2		2		
					1		1	1	
					15	**12**	**8**	**2**	**4**

There are 22 Arc/Coastal species which get to the Udzungwas and stop, 15 T-M Highland species which get to the Udzungwas and stop, and only 9 which cross out of the T-M Highlands onto other Arc mountains. These may repay closer study. They are:-

Papilio pelodurus
Mylothris crawshayi
Bicyclus simulacris
Neptis incongrua
Epamera congdoni
Epamera dubiosa
Uranothauma cuneatum
Uranothauma williamsi
Tuxentius ertli

Papilio pelodurus and *Tuxentius ertli* appear to be relatively widespread forest species whose range just happens to be restricted to our study area. *Neptis incongrua* may possibly fall into this category. The other six species are butterflies of high altitude forest or forest

margins, quite definitely T-M Highland species, with distributions all of which end in the Nyika Plateau. Their choice of foodplants does not seem to account for their altitude preference. We do not know the foodplant of *Uranothauma williamsi*, but of the others, *Mylothris crawshayi* and the two *Epamera* species are on Loranthaceae, *Bicyclus* will be on grass, and *Uranothauma cuneatum* is on *Myrica*. Only *Myrica* is restricted to higher altitudes.

How many species of Coastal Belt, Eastern Arc and Tanzania-Malawi Highland butterflies are there on each block? (Colour code, and place in or beside the block on the map.) Make into bar chart and/or stack bars on map. Numbers include spp endemic to each block.

Table 5.

		Coastal	Arc	T-M H
1.	N Highlands	-	-	-
2.	Kilimanjaro	1	-	-
3.	Pare Mts	1	1	2
4.	Teita Hills	1	2	-
6.	Usambara	12	33	10
7.	Nguru	11	25	7
8.	Uluguru	16	15	15
9.	Udzungwa	10	27	28
10.	Rubeho	1	5	21
11.	S Highlands	-	-	26
12.	Nyika (N Mal)	-	-	38
13.	Mlanje (S Mal)	-	-	19
16.	Matengo Hills	2	-	6

High numbers of coastals in Uluguru are due to Kimbosa forest. Low number of Arc spp may be due to clearance of medium alt forests for cult. If we inc Rubeho w Udz, pic becomes clearer, but justification for doing so is not seen. Show on map but del in tab - also del Matengos, N High and Kili.

CONSERVATION

It is now possible to prioritise the various blocks and zones in terms of conservation.

From a conservation point of view, every endemic species is important. As every link in the chain (except the Matengo hills) has at least one species endemic to it alone, all should be protected. But in terms of priorities, the greatest numbers in need of protection are in the Usambara, Nguru, Uluguru and Udzungwa Mountains, and the highlands of Malawi.

Some international attention is focused on the Usambaras, and forest reserve boundaries are generally respected. Outside of the reserves the tea estates provide protection for some smaller forest patches. Population pressures in the Ulugurus are high, but again forest reserve boundaries are generally respected.The situation in the Ngurus on the other hand is bordering on tragic. Cultivation encroachment on the forests is apparently uncontrolled. In 1999 we found the previously unknown male of *Ornipholidotos nguru* in an area of high forest. This area is now (2001) under cultivation. As this study has shown, the Ngurus are one of the four core areas of endemism in the Eastern Arc. If current trends continue, these forests will soon cease to exist.

Most of the Northern Malawi endemics enjoy protection in the Nyika National Park. In Tanzania, the Udzungwa National Park provides similar protection, and recent investigations have shown that most of the Udzungwa endemic species occur within the Park boundaries, which in any case may be extended.

The coastal forests of Kenya and Tanzania are seriously threatened. In Kenya the Arabuku-Sokoke forest is afforded some protection, as are the Shimba Hills. In Tanzania the Zaraninge forest may be included in a new National Park, and the Rondo Plateau is well protected. Outside of these areas the many small forests and areas of forest-grassland mosaic are being cleared at an alarming rate, with potentially catastrophic consequences for their butterflies.

Jon - What Forest Action Plans are being or could be put in place?? We need to end on a note suggesting what actions could be/are being planned.

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Appendix I

Table 6

A Current Checklist of the Endemic Butterflies of Tanzania

Hesperiidae	Distribution	Altitude
Celaenorrhinus cordeironis Kielland 1992	6	3
Celaenorrhinus kimboza Evans 1949	8	1
Celaenorrhinus rubeho Kielland 1990	10	5
Celaenorrhinus sanjeensis Kielland 1990	9	2
Celaenorrhinus uluguru Kielland 1990	8	4,5
Metisella carsoni Butler 1898	15	4-6
Metisella congdoni de Jong and Kielland 1983	9,11	(4),5
Metisella sp. (aff *willemi*, Mangalisa)	10	5
Metisella sp. (aff *medea*)	9,11	6?
Astictopterus bruno Evans 1937	1	5,6?
Astictopterus tura Evans 1951	7,9	1-4
Ampittia parva Aurivillius 1925	2,5,6,7,8,9,16	1-3
Ceratrichia bonga Evans 1947	6,8	2,3
Andronymus bjornstadi Congdon, Kielland & Collins 1998	15	3
Chondrolepis obscurior de Jong 1986	9,11	5,6
Chondrolepis similis de Jong 1986	9	4,5
Leucochitonea amneris Rebel & Rogenhofer 1894	1,9,10,11	2-4
Artitropa usambarae Congdon, Kielland & Collins 1998	6	3
Platylesches larseni Kielland 1992	15	3,4
Papilionidae		
Papilio sjoestedti Aurivillius 1908	1,2	(5)6
Papilio ufipa Carcasson 1961	15	3-6
Pieridae		
Mylothris kiellandi Berger 1985	6	5,6
Mylothris pluviata Berger 1980	7	3-6
Mylothris superbus Kielland 1985	7,9	3,4
Mylothris talboti Berger 1980	5,7,8,9	1-3(4)
Acraeidae		
Acraea (*Acraea*) *bergeriana* Pierre 1979	8,9	1-6
Acraea (*Acraea*) *manca* Thurau 1904	1,7	5
Acraea (*Acraea*) *punctimarginea* Pinhey 1956	6,8	1
Acraea (*Acraea*) *rohlfsi* Suffert 1904	6	3,4
Acraea (*Actinote*) *vuilloti* Mabille 1889	6,7,8,9,10	3-6
Satyridae		
Bicyclus danckelmani Rogenhofer 1891	6,7,9,10	3,4(5)
Bicyclus kiellandi Condamin 1986	5,9	2-4
Bicyclus mahale Congdon, Kielland & Collins 1998	15	2,3
Bicyclus pareensis	3	5
Bicyclus similis Condamin 1986	15	5,6
Bicyclus tanzanicus Condamin 1986	15	4-6

Bicyclus uzungwensis Kielland 1990	9,10	5,6
Physcaeneura jacksoni Carcasson 1961	3,5,7,9,10,16	1-4
Physcaeneura robertsi Kielland 1990	15	?4
Neocoenyra fuligo Kielland 1990	10	6
Neocoenyra fulleborni Thurau 1903	9,11,16	3,4(5)
Neocoenyra heckmanni Thurau 1903	9,10,11,16	(4)5,6
Neocoenyra jordani Rebel 1906	7	3,4
Neocoenyra mittoni Pinhey 1956	11	6
Neocoenyra parallelopupillata Karsch 1897	6	6
Neocoenyra petersi Kielland 1990	11	6
Neocoenyra pinheyi Carcasson 1961	14	4

Nymphalidae

Hypolimnas antevorta Distant 1880	6	3
Sallya pseudotrimeni Kielland 1985	5,8,9	3,4(5)
Cymothoe amaniensis Rydon 1980	6	3
Cymothoe aurivillii Staudinger 1899	7,8,9,10	(3)4-6
Cymothoe collinsi Rydon 1980	2	5
Cymothoe magambae Rydon 1980	3,6	5,6
Pseudathyma uluguru Kielland 1985	8	6
Pseudathyma abri	7	4
Euryphura kiellandi Hecq 1989 Ntakatta - Mihumu.	15	3,4
Euphaedra confina Hecq 1992	15	4
Charaxes chunguensis White and Grant 1986	10	5,6
Charaxes congdoni Collins 1989	9,11,16	5,6
Charaxes grahamei van Someren 1969	15	3,4
Charaxes lucyae van Someren 1975	6,7,9	3-5
Charaxes mccleeryi van Someren 1972	8,9	2-6
Charaxes pembanus Jordan 1925	17	1
Charaxes phenix Lequeux and Turlin 1993	7,9	3
Charaxes prettejohni Collins 1990	L Victoria	3
Charaxes usambarae van Someren & Jackson 1952	6,7	3-5(6)

Lycaenidae

Alaena bicolora Bethune-Baker 1924	14	2,3
Alaena bjornstadi Kielland 1993	15	4
Alaena ferrulineata Hawker-Smith 1933	1	3-5
Alaena kiellandi Carcasson 1965	15	3-5
Alaena madibirensis Wichgraf 1921	14,15	4
Alaena sp. nov (Iringa)	14	5
Pentila rondo Kielland 1990	5	3 (800-850m)
Ornipholidotos tanganyikae Kielland 1983	15	3,4
Ornipholidotos nguru Kielland 1987	7	4
Mimacraea gelinia Oberthur 1893	6,7,9	3,4
Mimacraea marginata Libert 1999	1	3
Baliochila congdoni Kielland 1990	7	4
Baliochila lequeuxi Kielland 1994	17	1
Baliochila nguru Kielland 1986	7	4
Baliochila pringlei Stempffer 1967	6	3
Baliochila sp nr *pringlei*	9	3
Baliochila warrengashi Collins and Larsen 1996	6	3
Baliochila sp nov (1)	9	3
Baliochila sp nov (2)	9	3
Baliochila sp nov (3)	8	4
Deloneura abri Congdon & Collins 1998	17	1
Cephetola tanzaniensis Libert 1999	15	3,4
Aslauga tanga Libert and Collins 1997	6,7	3,4

Lachnocnema inexpectata Libert 1996	15	3
Lachnocnema tanzaniensis Libert 1996	11,15,16	3-5
Lachnocnema unicolor Libert 1996	7	4
Spindasis collinsi Kielland 1980	6	5,6
Spindasis tanganyikae Kielland 1990	15	3-5
Axiocerses kiellandi Henning and Henning 1996	9	3,4
Axiocerses styx Rebel 1905	7,8	1,2
Epamera bamptoni Congdon & Collins 1998	14	3,4
Etesiolaus pinheyi Kielland 1986	8	1-3
Argiolaus montana Kielland 1978	15	4-6
Argiolaus sp. nr *crawshayi* (Mbisi)	15	6
Stugeta mimetica Aurivillius 1916	14	4
Pilodeudorix rodgersi Kielland 1985	7,8,9,10	5,6
Pilodeudorix nr *zela* Hewitson 1869	3,9	3
Capys usambarae Congdon & Collins 1998	6	3
Capys sp. n	7,15	4-6
Anthene madibirensis Wichgraf 1921	14	4
Anthene montana Kielland 1990	8	5,6
Anthene mpanda Kielland 1990	14,15	4,5?
Anthene uzungwae Kielland 1990	9,11	5,6
Anthene sp. nr *uzungwae* (Magamba)	6	4?
Triclema nr *nigeriae* Aurivillius 1905	9	5
Uranothauma kilimensis Kielland 1985	2	6
Uranothauma lukwangule Kielland 1987	8	6
Uranothauma nguru Kielland 1985	7	6
Uranothauma usambarae Kielland 1980	6	5,6
Uranothauma uganda Kielland 1980	8	5,6
Harpendyreus berger Stempffer 1976	8	6
Lepidochrysops carsoni Butler 1901	?15 Fwambo	?
Lepidochrysops chala Kielland 1980	15	6
Lepidochrysops kennethi Kielland 1986	9	5
Lepidochrysops kilimanjarensis Strand 1909	2	66
Lepidochrysops mpanda Tite 1961	15	5
Riodinidae		
Abisara zanzibarica Collins 1990	17	1

Tanzania endemics total 123

Table 7. Species no longer considered to be endemic to Tanzania

See Congdon & Collins 1998

Acraea (*Acraea*) *utengulensis* Thurau 1903	Also in Zambia
Neita orbipalus Kielland 1990	?Also in Kenya
Charaxes gerdae Rydon 1989	Valid? *ethalion fisheri*?
Alaena dodomaensis Kielland 1983	Also in Kenya
Baliochila pseudofragilis Kielland 1976	Also Kenya?
Virachola mpanda Kielland 1990	Invalid *edwardsi*?
Virachola ufipa Kielland 1978	Invalid *odana*?
Harpendyreus boma Bethune-Baker 1926	Invalid *marungensis*
Uranothauma williamsi Carcasson 1961	Also in Malawi
Tuxentius stempfferi Kielland 1976	?Also in Kenya
Bicyclus simulacris Kielland 1990	Also in Malawi