LAND MOLLUSCS OF ZANZIBAR ISLAND (UNGUJA), TANZANIA, INCLUDING A NEW SPECIES OF *GULELLA* (PULMONATA: STREPTAXIDAE)

B. ROWSON

Dept. Biodiversity & Systematic Biology, National Museum of Wales, Cardiff, UK

Abstract The land molluscs of Zanzibar island (Unguja), Tanzania are reviewed based on a) published records and b) a quantatitive survey undertaken at Jozani Forest, Unguja in 2000. 58 species are recorded from Unguja, including 16 new records and a new species of Gulella *(Pulmonata: Streptaxidae). Two E. African species and one Aldabran species are placed in synonymy. The resulting annotated checklist allows a comparison of the Unguja fauna with that of other parts of E. Africa and more oceanic Indian Ocean islands. Only three additional taxa are yet recorded from the other major Tanzanian coastal islands, Pemba and Mafia. Of the 61 species, seven (11%) are putative endemics for Unguja and/or Pemba/Mafia, 14 (23%) show coastal E. African distributions, 24 (39%) show wider E. African distributions, and 16 (26%) show very wide distributions in which anthropogenic introduction has often played a part. 11 (18%) also show affinities with the oceanic Indian Ocean islands; these are briefly discussed. Levels of endemism in Jozani and on Unguja as a whole are comparable to mainland E. African coastal forests that have been subject to similar surveys. Relative to these forests, species richness at Jozani is high (29 species) but variable and skewed towards a few abundant species. Data are provided on a further 25 species recorded from "Zanzibar" but of dubious localisation or identity, as a reference for future work in the region.*

Key words Land molluscs, Tanzania, Zanzibar, Unguja, Gulella tracheia*, endemism*

INTRODUCTION

The E. African coastal land mollusc fauna remains poorly explored and there is a substantial taxonomic impediment to further studies and conservation efforts (Verdcourt, 2000; Seddon *et al.*, 2005). The impediment is in the form of poorly characterised species about which relevant data and specimens are scattered and sometimes inaccessible, especially in Africa. This can be addressed, in part, by synthetic treatments in which the area and taxa under review are clearly delineated (e.g. Tattersfield, 1998; Seddon *et al.*, 2001; Lange & Mwinzi, 2003). Such studies also permit a certain amount of systematic and biogeographic analysis, including the assessment of endemism. Endemism, rather than diversity, is the preferred indicator of biodiversity importance of E. African coastal reserves (Burgess *et al.*, 1998). The Tanzanian island of Unguja is, on the one hand, a clearly defined area supporting a variety of habitats that can be considered as a biogeographic unit and potential area of endemism. On the other, as the nucleus of a variably-sized political entity under the name of "Zanzibar" (or variations thereof) it has created confusion in collections and in the literature which only serves to reinforce the taxonomic impediment. The present study addresses this by reevaluating the scattered published records and excluding the least plausible from a checklist for the island. New data from Jozani Forest, Unguja are integrated with this to form what is hoped will become a point of reference for future work. A qualitative analysis of the affinities of the fauna is then given, with the new quantitative data providing an estimate of diversity and a basis for comparison with other E. African coastal forests.

Contact author : ben.rowson@museumwales.ac.uk

UNGUJA AND THE SURROUNDING AREA

The island of Unguja (6º10'S, 39º10'E) lies in the Indian Ocean, separated from the Tanzanian mainland by a narrow (c35km) and shallow (<200m deep) channel (**Fig. 1**). Unguja has been separated and rejoined to the mainland repeatedly, most recently during the Pleistocene climatic oscillations, having remained an island since the end of the last glacial period c10,000 years ago (Clarke & Burgess, 2000). A fault in the Pliocene (c6m years ago) produced the deeper Pemba channel, by which Pemba has been separated ever since. Throughout this time, whether as islands or not, Unguja, Pemba and Mafia have been the easternmost and most maritime parts of Tanzania. Today, mean annual rainfall and mean temperatures on the islands are slightly higher

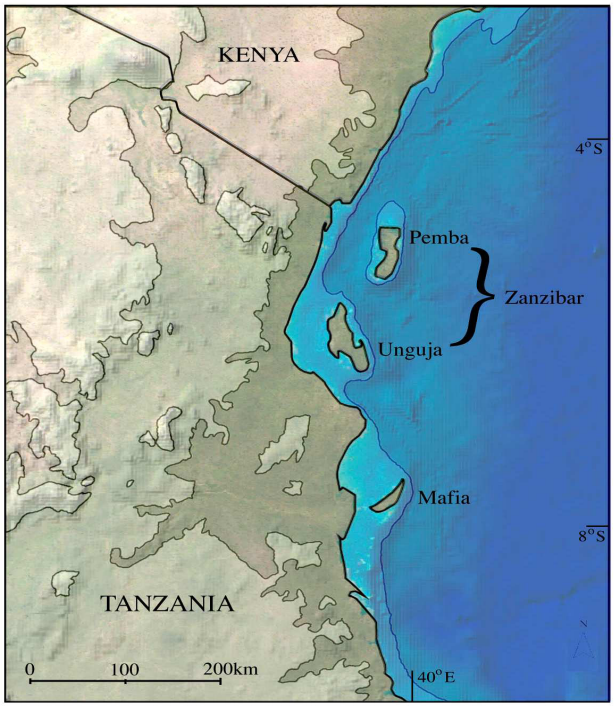

Fig. 1 Unguja and the surrounding area. Contours: 200m and 1000m (above sea level); 200m (below sea level). The land below 400m, including the islands, roughly corresponds to the Zanzibar-Inhambane vegetation mosaic of White (1983), in which the coastal forest fragments are scattered.

than on the mainland, mean rainfall approaching 2000mm per year in some parts and average temperature reaching 26.9°C on Unguja (Clarke & Burgess, 2000; Clarke, 2000). Geology and climatic history are otherwise similar to the adjacent mainland and the other Tanzanian islands, the surface circulation of the western Indian Ocean having varied little since before the Pleistocene (Prell *et al.*, 1980). Like the adjacent coast, most of the annual rainfall is received during one short and one long rainy season at the hottest times of each year. Unguja is about 1650km^2 in area and does not exceed 100m elevation, but supports a variety of semi-natural terrestrial habitats as well as clove plantations and other cultivation. These are included in the Zanzibar-Inhambane regional mosaic, a phytogeographical unit whose flora covers most of the area below 400m elevation along the coast (White, 1983; Burgess *et al.*, 1998; Burgess & Clarke, 2000). In turn this is part of a larger Swahili regional centre of endemism recognised by White (1983). Within these vegetation types, forests occurring as small (<20km^2) scattered fragments make up the Coastal Forests area of endemism, which is recognised as being of great biodiversity importance and under intense human and climatic pressure (Burgess *et al.*, 1998; Burgess & Clarke, 2000; Brooks *et al.*, 2002). The forests harbour many narrow-range endemics, most of which are thought to be relict paleoendemics of wider forest cover in pre-Miocene times (Burgess *et al.*, 1998; Burgess & Clarke, 2000). The total amount of forest remaining on Unguja is listed by Burgess *et al.* (2000) as 13-15km^2. Most of this is gazetted as Jozani Forest Reserve (6°15'S, 39°24'E), which is supported by a rich organic soil in a solution basin in the ubiquitous coastal coral rag (Robins, 1976).

Several factors suggest that Unguja is likely to support a diverse land mollusc community, possibly including paleoendemic species. Firstly, it supports a small amount of coastal forest at Jozani and elsewhere. Forests are thought to harbour the great majority (83%) of the E. African mollusc fauna and most of the endemic species (Verdcourt, 1972, 2000). Verdcourt (2000) lists 145 terrestrial species from coastal E. Africa (corresponding to the Zanzibar-Inhambane regional mosaic), of which 91 (63%) are said to occur in forests. 91 (63%) of the 145 coastal species are said to be endemic to coastal E. Africa, including 69 (76%) of the 91 species occurring in forests and 22 (55%) of the 40 non-forest species. Endemism among coastal forest species is thus more pronounced than among the coastal species in general. This still is true when freshwater molluscs are included (Verdcourt, 2000). Tattersfield (1998) reported high species turnover between mainland coastal forests, perhaps as a result of narrow-range endemics. Secondly, Emberton *et al.* (1997) found that both diversity and endemism in land mollusc morphospecies was more pronounced in coastal forests of northern or "north central" (i.e. due W. of Unguja) latitude than in more southerly coastal forests or montane forest in the W. Usambara Mountains. Thirdly, persistence of many species including paleoendemics in forest fragments is thought to have been favoured by the long-term climatic stability of the region (Fjeldså & Lovett, 1997; Burgess & Clarke, 1998; 2000). The maritime climate of Unguja at the extreme E. coast of Tanzania may have been particularly stable and thus favourable. Thus Unguja, given this combination of factors, is apparently likely to

support species endemic to the island as well as those endemic to coastal E. Africa. Burgess *et al*. (1998) found that endemism per unit area of coastal forest was high on the islands of Pemba and Unguja. However, in the case of Unguja the separation by sea may have been too recent to allow the evolution of island neoendemics and it is the factors favouring the survival of palaeoendemics that are most relevant. Bequaert (1950) and Moreau (1966) noted that the fauna of Unguja was "continental" in this respect.

PUBLISHED RECORDS

Unguja's accessibility and status as a slave and spice port, staging post and diplomatic centre led to a certain amount of collecting activity. Most of the material was worked on by European taxonomists dealing with one or a few species at a time, and usually in works dealing with species from other areas. There are few works that attempt to review or synthesize the whole E. African fauna, but both von Martens (1897) and Verdcourt (1972, 1983) have included "Zanzibar" (in the modern sense, see below) in their distributional lists. More often, studies describe or refer to "Zanzibar" material in dealing with other East African molluscs (e.g. Bourguignat, 1879; Thiele, 1911; Connolly, 1922a). J. S. Gibbons, an English ship's surgeon, collected marine and land snails from "Zanzibar" (Unguja) and Mozambique during the 1870s and produced an 89 page manuscript (circa 1875) entitled "Synopsis of East African Shells". Now in NMW, this manuscript contains some observations on the shells described by Gibbons (1879) and by J. W. Taylor (1877a, 1877b, 1880) in papers that deal mostly with the Unguja material. Verdcourt (1981) offered a biography of Gibbons and an update of the Gibbons and Taylor names. Apart from these, Germain (1918) is the only work to address the land molluscs of Unguja exclusively, treating 14 species. The freshwater molluscs of Unguja were dealt with by Mozley (1939).

JOZANI FOREST SURVEY

A small collection was made in Jozani Forest, Unguja on 11-12 March 2000 by C. Ngereza, M. B. Seddon and P. Tattersfield using a standardized survey method (see Tattersfield, 1996) that included drying and sieving leaf litter as well as direct searching. In the terminology of this method (Tattersfield, 1996) 3 replicates, each with 2 person hours' direct search and with the sieving of 4 litres of litter, were made at each of 2 plots in the forest. The plots, referred to as plot I and II (on 11 March and 12 March respectively) were chosen by the collectors for their predicted high diversity and abundance of molluscs based on their many years' combined collecting experience. One further "miscellaneous" collection from each plot, where the direct search time was not specified, added several more specimens but not species and was not included in the quantitative analysis. The Jozani survey confirmed the presence of some species and added several more, most of them small. This data has been incorporated into the checklist and Table 1. The quantitative results are discussed after the checklist. The Jozani material is held in the National Museum of Wales (NMW) with representative specimens in the National Museum of Tanzania, Dar es Salaam (NMT); the distribution of the types of the new species of *Gulella* is given with its description below.

NOTE ON PLACE NAMES

Certain place names relating to Zanzibar require explanation because they potentially carry different meanings on specimen labels or in the literature. The name "Zanguebar" was used for several centuries to refer to the East coast of Africa between Mozambique and Somalia and, judging by old European maps, an indefinite distance (corresponding to several hundred km) inland. Zanguebar must sometimes have been judged to include the islands, but "Zanzibar" referring specifically to Unguja is evident as early as 1562. The modern "Zanzibar" is made up of the island of Unguja (very often treated as Zanzibar 'proper') together with the island of Pemba and numerous surrounding islets. Thus recognized, Zanzibar was a sultanate with transitory colonial allegiances. Following the independence of Zanzibar from Britain in 1963, Zanzibar and Tanganyika formed the union of Tanzania in 1964 (full name: United Republic of

Tanzania). Zanzibar is also the name of a large town (Zanzibar's capital) on the west coast of Unguja. Other islands of the Tanzanian coast (e.g. Mafia, Songo Songo, Kilwa) and various islets are part of Tanzania, but not Zanzibar. Various other alternative spellings occur, among them "Sansibar" (of German authors), "Zenzibar", "Oungouja", "Penda" and "Monfia". Names for islets and sites within the islands also vary as is common with African localities.

In the malacological literature and in collections, "Zanguebar", Zanguébar", "Zanquebar" and "Zanzibar" appear. Specimens bearing these names and collected before about 1900 must be interpreted very carefully; similarly, some material may have been labelled retrospectively as species described from "Zanzibar" became more widely known to collectors. Gibbons (1875 MS) alludes to the "East Coast Islands" and consistently uses "Zanzibar"; he also collected much of his material on "Bawri Island" (Bawi), an islet right opposite the port of Zanzibar (town). He makes no reference to Bagamoyo or other mainland Tanzanian localities (as he does with Mozambique) so I am fairly satisfied that Gibbons' Zanzibar collections are from Unguja and its islets. Bourguignat (1889) contrasts "Zanzibar" with "Zanguébar" in juxtaposition in parts of the text where he is using his own terms and not simply repeating others' (e.g. p133), so it is clear he cared about the distinction. However, Bourguignat (1889) also uses (e.g. p69) "île Zanzibar" so where "Zanzibar" appears on its own it is not certain whether he is referring to Unguja or not. Von Martens (1897) and most subsequent authors have used "Zanzibar Island" where necessary and draw a distinction between the island and the mainland. In such cases I interpret "Zanzibar Island" as Unguja. The "Zanzibar" of Germain (1918) is probably Unguja – the collector A. Raffray, source of the material in Germain (1918) was the French consul there, and also because Germain cites "Zanguebar" verbatim when dealing with older records. However, Germain's treatment of his *Trochonanina crenulata* is inconsistent between his 1905 and 1920-1923 publications (see checklist) and should be considered an exception. Connolly's (1928) work on N.E. Africa provided a table of distribution which included "Zanzibar", but judging from the scope of this publication and the xerophilic nature of the species included this refers to northern part of the coast and not to Unguja. By the time of, e.g., Bequaert & Clench (1936a), more precise localities such as "Chuaca" (Chwaka, on Unguja) make interpretation more reliable. Verdcourt's (1983) checklist of E. African molluscs included most of the earlier records and added several more, using the abbreviation "Z" to indicate Unguja. Verdcourt identified a small collection of mostly larger land snails collected from Unguja by the marine malacologist Ostheimer in 1957; these specimens are now in the National Museum of Kenya (NMK) and the Academy of Natural Sciences, Philadelphia (ANSP) (B. Verdcourt and P. Callomon, pers. comms.). Because of the difficulties with earlier works it is not possible to localise all records precisely. In the list that follows I have tried to indicate where taxa were recorded only from "Zanzibar" and where I am fairly certain whether this refers to Unguja or not.

CHECKLIST

The following list gives details of taxa recorded from Unguja with a brief statement of distribution. The two species recorded only from Pemba, and the one recorded only from Mafia, are also listed. Table 1 summarises some of this information. Because of the problems with locality names and localization, I quote published localities for "Zanzibar" or variations thereof verbatim, followed by my interpretation in square brackets. The list also includes records from the Jozani Forest survey (2000) and several other unpublished East African surveys conducted by NMW 1994-2004. East African synonyms are given, except for full synonymies for the Achatinidae for which see Bequaert (1950) and for some very wide-ranging species. Details of identification are given only where relevant to the verification of records; specimens of most species and some other relevant material are also figured (Figs 2–59). I have tried to avoid using "open nomenclature" (e.g. names with "sp. aff." or "cf.") throughout, despite being less than 100% certain about some of my identifications (I explain where this is the case, e.g. see *Trachycystis lamellosa*). The exception is *Pseudoglessula subolivacea* which I treat as an aggregate or complex following Verdcourt (1967). In several groups, however, the morphological limits of African

species are barely known and almost every species would have to be treated in this manner. This risks misleading future workers by making it difficult to detect or distinguish narrow-range endemics, disjunct distributions, recent introductions, or widespread, variable species, all of which phenomena appear to occur in the main African families. This problem has misled, for example, in the study of Indian Ocean island snails until addressed by van Bruggen (1975a, b, 1975-1977). As a result some of the range or habitat extensions implied here are large, but they need not be controversial. The photographs and specimens at NMW can act as vouchers should this be the case.

Family treatment and sequence follows Herbert & Kilburn (2004), chosen for ease of comparison. The status and makeup of some families (e.g. Urocyclidae) is far from resolved. Numbers in brackets following the family name are the number of species accepted in this list. Amphibious snails (e.g. Ellobiidae, Truncatellidae) are not dealt with here. Succineidae are not, as is sometimes stated, all amphibious (Barker, 2001) and so the two species recorded from "Zanzibar" are included.

A number of species have been excluded from a list for Unguja by earlier authors or myself on the grounds of dubious localization or dubious identity. I consider it improbable that these species were ever found on Unguja. Data on these species are given at the end of the list with evidence for their exclusion and summarized in Table 2. Note that the list of excluded species is not an attempt to list all taxa that might yet be found on Unguja. Further collecting may clarify their status; in the meantime I hope that providing this information will mean they do not have to be dealt with in detail in other studies.

ABBREVIATIONS OF MUSEUMS MENTIONED

ANSP Academy of Natural Sciences, Phildelphia, USA
BMNH Natural History Museum, London, UK
IRSNB Royal Institute of Natural Sciences, Brussels, Belgium
MCZ Museum of Comparative Zoology, Harvard, USA
MNHN National Natural History Museum, Paris, France
MRAC Royal Museum of Central Africa, Tervuren, Belgium
NMK National Museum of Kenya, Nairobi, Kenya
NMS National Museum of Scotland, Edinburgh, UK
NMSA Natal Museum, Pietermaritzburg, South Africa
NMT National Museum of Tanzania, Dar es Salaam, Tanzania
NMW National Museum of Wales, Cardiff, UK
SMF Senckenburg Museum, Frankfurt, Germany
ZMB Zoological Museum, Berlin, Germany

ASSIMINEIDAE (1)

Eussoia aurifera (Preston, 1912)
Fig. 18.

Distribution Gazi, Kenya (Preston, 1912; type locality); Kilifi, Kenya and "Zanzibar, Tumbatu Island; Poopu" [islet off Unguja] (Brown, 1980); "Kenya & Zanzibar [Unguja] (coast)" (Verdcourt, 1983).

Remarks Brown (1980) treated this as a terrestrial rather than aquatic species and excluded it from his later treatment of freshwater molluscs of Africa (Brown, 1994). Verdcourt (2000) treated this in "*Assiminea* gen. nov. nr. *Omphalotropis*."

MAIZANIIDAE (1)

Note on Maizaniidae and Pomatiasidae in East Africa: these terrestrial caenogastropods clearly exist as polytypic species, which are often poorly defined. Emberton (1995) found much of the current taxonomy "irrelevant" to the results of a thorough morphological and allozyme study in Madagascan species of *Tropidophora*. Herbert & Kilburn (2004) have doubts about the identity of most of the South East African species in both groups. Having some experience with collections of East African *Maizania* and *Tropidophora* I hypothesise that the situation is similar for these groups, although Verdcourt (1964, 1972) suggests there are taxa with some biogeographical value.

Maizania zanzibarica Bequaert & Clench, 1936
Fig. 2

Distribution "Chuaca, east side of Zanzibar Island" [Chwaka, Unguja] (Bequaert & Clench, 1936a; type locality); "Jembiani, 5 m S. of Paje,

Figure	Genus	Species	Unguja	Jozani (2000 survey)	Tropical W. Afr.	E. Afr. highlands	E. Afr. arid areas	E. Afr. coast	S.E. Afr. Coast (Moz., KZ-Natal)	S.E. Afr. inland (Malaw., Zamb.)	Pemba	Mafia	Comoros	Aldabra	Seychelles	Madagascar	Tropical Asia	First Unguja record by	Certainty of Unguja record	Certainty of identification
18	*Eussoia*	*aurifera*	*					*										Brown, 1980	+++	+++
2	*Maizania*	*zanzibarica*	*					?										Bequaert & Clench, 1936a	+++	++
3	*Tropidophora*	*zanguebarica*	*	65				*										Petit, 1850	+++	++
-	*Laevicaulis*	*alte*	i?		*			*	*								i	Forcart, 1953	+++	++
-	*Laevicaulis*	*zanzibaricus*	*			*		*										Forcart, 1953	+++	+++
19	*Pupoides*	*coenopictus*	*				*	*									*	Taylor, 1880	+++	+++
12	*Gastrocopta*	*klunzingeri*	*	2	*	*		*										New record	+++	++
9	*Nesopupa*	*minutalis*	*	2	*			*					*					New record	+++	+
13	*Nesopupa*	*bisulcata*	*	2	*	*	*	*										New record	+++	++
27	*Edouardia*	*conulina*	*								*							von Martens, 1869	+++	+++
28	*Edouardia*	*tumida*	*	3?				*										Taylor, 1877a	+++	++
29	*Rachis*	*punctata*	i?		i			*	?								*	Taylor, 1877a	+++	+++
31	*Rhachidina*	*braunsi*	*			*		*	?									von Martens, 1869	+++	++
-	*Rhachidina*	*melanacme*	i?			?		*	*	*								Verdcourt, 1983	+++	++
30	*Rhachidina*	*mozambicensis*	*			?		*	*									Gibbons, 1879	+++	++
-	*Rhachistia*	*hildebrandti*	*					*										Verdcourt, 1983	+++	++
-	*Rachistia*	*picturata*	*					*										Verdcourt, 1983	+++	++
16	*Cecilioides*	*kalawangaensis*	*	1	*													New record	+++	++
21	*Cecilioides*	*callipeplum*	*	1			*											New record	+++	++
32	*Subulina*	*octona*	i		*			*									i	von Martens, 1897	+++	+++
25	*Subulina*	*intermedia*	*					*										Taylor, 1877b	+++	+++
17	*Pseudopeas*	*igembiense*	*	15		*		?										New record	+++	++
23,24	*Opeas*	*delicatum*	*	83		*		*										Verdcourt, 1983	+++	++
22	*Opeas*	*lamoense*	*	35				*	*									Verdcourt, 1983	+++	++
26	*Lamellaxis*	*gracilis*	i			*		*									i	Verdcourt, 1983	+++	++
36	*Pseudoglessula*	*subolivacea agg.*	*	133		*		*	*	*								Taylor, 1877a	+++	+++
34, 35	*Homorus*	*usagarica*	*			*		*										Germain, 1918	+++	+++

43	*Achatina*	*allisa*	*	46		?		*			*	*								Bequaert, 1950	+++	+++
46	*Achatina*	*eleanorae*										*								Mafia: Mead, 1995	+++	+++
45	*Achatina*	*fulica agg.*	*			?	?	*	*	?		*					i	i		Gibbons, 1879	+++	++
42	*Achatina*	*reticulata*	*	9		*		*												Bequaert, 1950	+++	+++
41	*Edentulina*	*obesa*	*			*		*			*	*								Taylor, 1877a	+++	+++
44	*Edentulina*	*ovoidea*	*	7		*		*	*				*				i			Verdcourt, 1983	+++	+++
38	*Gonaxis*	*denticulatus*	*			*		*												von Martens, 1897	+++	++
37	*Gonaxis*	*gibbonsi*	*			*		?												Taylor, 1877a	+++	+++
39	*Gonaxis*	*quadrilateralis*	*					*												Germain, 1918	+++	+++
57	*Gulella*	*baccata*	*	12		*														New record	+++	++
50	*Gulella*	*jod*	*	12		*		*		cr?			cr?							New record	+++	+++
54	*Gulella*	*peakei continentalis*	*	22		*		*	*				cr?	cr?						New record	+++	+++
51	*Gulella*	*minutissima*	*																	Thiele, 1911	+++	++
56	*Gulella*	*radius*	*	12		*		*	cr?				cr?							New record	+++	+++
58	*Gulella*	*sexdentata*	*		*	*		*		*										von Martens, 1869	+++	++
52	*Gulella*	*streptostelopsis*	*	7		cr?		cr?		*			cr?							New record	+++	+++
53	*Gulella*	*tracheia*	*	5		*														New species	+++	+++
55	*Gulella*	*vicina*	*	7	*	*		*	cr?	*										New record	+++	++
47, 48	*Streptostele*	*acicula*	*	5		*							*	*	*		i			New record	+++	+++
49	*Streptostele*	*bawriense*	*																	Gibbons, 1879	+++	++
15	*Trachycystis*	*lamellosa*	*	1		*														New record	+++	++
-	*Deroceras*	*reticulatum*	i?						i											Ellis, 1969	++	++
14	*Afroguppya*	*rumrutiensis*	*	5	*	*		*	*	*				*						New record	+++	+++
-	*Afroguppya*	*seminium*	*		*	*		*	*	*										Verdcourt, 1963a	+++	+++
-	*Kaliella*	*barrakporensis*	*	4	*	*		*	*	*			*				*	*		New record	+++	+++
-	*Sitala*	*jenynsi*	*	2				*	*											Germain, 1918	+++	+++
4	*Thapsia*	*curvatula*	*	107		*		*												Verdcourt, 1983	+++	+
7	*Trochonanina*	*bloyeti*	*			*														Germain, 1918	+++	++
6	*Trochonanina*	*mozambicensis*	*			*	*	*	*	*	*									Gibbons, 1879	+++	+++
-	*Elisolimax*	*roebucki*									*									Pemba: van Goethem, 1977	+++	++
40	*Pembatoxon*	*insulare*	*	4							*									New record	+++	+++
-	*Trichotoxon*	*heynemanni*			*	*	*	*			*									Pemba: Simroth, 1910	+++	+++
20	*Quickia*	*concisa*	*	1	*	*		*					*							Verdcourt, 1983	+++	++
33	*"Succinea"*	*pseudomalonyx*	*		*															Verdcourt, 1983	+++	++

Table 1 Summary of checklist and species distributions (*, present; i, introduced; cr, a likely close relative present; ?, uncertain record). Numbers in the Jozani column are the total number of specimens recorded in the 2000 survey. The last two columns express difficulties in localising records to Unguja and verifying Unguja identifications (+++, most certain; ++ less certain; + uncertain; - unlikely). For more detail see text of checklist.

Zanzibar" [Unguja] (Verdcourt, 1964).
Remarks Bequaert & Clench (1936a) noted this species' similarity to *M. wahlbergi* (Benson, 1852) from which it differs only in having a "greatly depressed spire". Verdcourt (1964) also relies solely on this difference in his key and treated it as a species allopatric to *M. wahlbergi*, whose distribution is said to be very wide (coastal Kenya to Eastern Cape, South Africa). Verdcourt suggested that more material might indicate that it "deserves only subspecific rank". In his list of coastal molluscs (2000) Verdcourt did not include this species. Given the findings of Emberton (1995) on *Tropidophora* (see above) its status will remain unresolved without further work.

POMATIASIDAE (1; 2 EXCLUDED)

Tropidophora zanguebarica (Petit, 1850)
Fig. 3
Distribution "cette coquille a été rapportée par M. Guillian, qui l'a trouvée en grand nombre sur l'île de Zanzibar" [Unguja] (Petit, 1850; type locality); "Zanzibar" [Unguja] and Mozambique (Gibbons, 1879); Kikambala, Kenya and Pangani, Tanzania (Verdcourt, 1983); Jozani Forest (2000 survey).
Remarks The identity of this species is difficult to confirm and it is likely to be polytypic (see note above). Petit (1850) noted some similarity with empty shells from Mauritius. Gibbons (1879) said of this species "At Zanzibar [as compared to Mozambique] it is scarce and local, and the shells are rather different, being larger and more tumid, with a less distinct suture" and "variation in colour and markings is sometimes considerable". Verdcourt (1983) lists other species from Zanzibar [Unguja] and various other eastern localities that are likely to have been confused with *T. zanguebarica* by other authors. These are: i) *T. letourneuxi* (Ancey MS in Bourguignat, 1887), ii) an unnamed "sp." from Zanzibar [Unguja] and iii) an unnamed "sp. (aff. *letourneuxi* Bgt. & *scaba* H. Adams)". These are clearly very closely related to *T. zanguebarica*, but the nature of the relationship is virtually unknown in such variable species. Shells of *T. letourneuxi* and *T. zanguebarica* in the Melvill-Tomlin collection (NMW.1955.158) and many other *Tropidophora* in other museums from various East African localities are not easily distinguishable. I suggest all small *Tropidophora* from Unguja (and nearby coastal areas) that resemble *T. zanguebarica* be referred to that species until a thorough revision is available.

VERONICELLIDAE (2)

Laevicaulis alte (Férussac, 1821)
Vaginula brevis Fischer, 1872 syn. by Forcart, 1953
Distribution Pondicherry, India (type locality), very many African and other tropical localities (Forcart, 1953); Zanzibar [probably Unguja, as considered distinct from Tanganyika] (Forcart, 1953; type locality of *V. brevis*).
Remarks Introduced very widely, but probably originally African (Forcart, 1953). Gibbons (1879) recorded an "*Onchidium* sp. indet." ("Vaginulidae") from moss in ravines on Bawri Island (near Unguja). Verdcourt (1983) comments the *Onchidium* sp. is "never confirmed". This may have belonged to either *Laevicaulis* listed here. Alternatively, a semi-marine *Onchidium* can be found intertidally around Dar-es-Salaam (pers. obs., 2004).

Laevicaulis zanzibaricus Forcart, 1953
Distribution "Zanzibar" [Unguja] (Forcart, 1953; type locality); near Mombasa, Kenya (Forcart, 1954); near Amani, Tanzania (Verdcourt, 1983).
Remarks none.

PUPILLIDAE (1)

Pupoides coenopictus (Hutton, 1834)
Fig. 19
Pupoides coenopictus samavaensis (Paladilhe, 1872)
Bulimus bawriensis Taylor, 1880 syn. by Verdcourt, 1981
Pupoides coenopictus sennaariensis (Pfeiffer, 1855)
Bulimus zanguebaricus Taylor, 1880 syn. by Verdcourt, 1981
Leucocheilodes chanlerensis Preston, 1912 syn. by Verdcourt, 1983
Distribution Bombay, India (type locality; Seddon, 1994); "Zanzibar" [Unguja] (Taylor, 1880, type locality of *B. bawriensis* and *B. zanguebaricus*); very widespread in sub-Saharan Africa, North Africa and Asia (Seddon, 1994; as *P. coenopictus*). The two subspecies listed above are also listed from dry inland areas of East Africa by Verdcourt (1983).
Remarks Germain (1918) suggested the occur-

rence on Unguja was a result of introduction with plants from Asia (d l'Inde), as were the occurrences at other "nombreuses localités africaines". One lot from MNHN ("*Buliminus caenopictus* [*sic*] *ex.* Grandidier 1864" with the locality "Ile Zanzibar") contains two *P. coenopictus* together with a *Truncatella* sp. and one large unidentified non-cerastid enid. I think the latter must be wrongly included, being of a kind not found in sub-Saharan Africa.

CHONDRINIDAE (1)

Gastrocopta klunzingeri (Jickeli, 1873)
Fig. 12

Distribution Ethiopia (Adam, 1954; type locality); Senegal, Democratic Repubic of Congo; Gazi, Kenya and Dar-es-Salaam, Tanzania (Adam, 1954) central Kenya (Verdcourt, 1983); Mbudya Island, coastal Tanzania (C. Ngereza, unpubl., 1998); Jozani Forest (2000 survey).
Remarks This genus, reviewed by Adam (1954) presents identification difficulties similar to those in *Nesopupa* (see below).

NESOPUPIDAE (2)

Nesopupa (Insulipupa) minutalis (Morelet, 1881)
Fig. 9 (see also figs. 10, 11).

Distribution Mayotte, Comoros (type locality; Adam, 1954); Senegal (Adam, 1954); coastal Kenya (Verdcourt, 1983); Jozani Forest (2000 survey).
Remarks The *Insulipupa* of Africa and Indian Ocean islands were last reviewed by Adam (1954, 1957). They are difficult to tell apart and have wide distributions based on few records. Any biogeographical value may be compromised by the ease of which these tiny species can passively disperse or be spread by man. A Jozani specimen (Fig. 9) has a developing parieto-palatal tooth resembling that in Adam's (1954) figure of *N. minutalis*. However, an *Insulipupa* from Mbudya Island (1998), an onshore island near Dar es Salaam (Fig. 10), and a specimen of *N. (I.) peilei* Madge, 1938 from Mauritius (NMW.1955.158.24238, *ex auct*.; Fig. 11) also show resemblances. Verdcourt (2000) marked both species with a "?" indicating doubts over their identity. Adam (1954) gave the distribution of *N. (I.) peilei* as Mauritius alone, noting that it was intermediate in appearance and distribution between *N. (I.) minutalis* and *N. (I.) malayana* (Issel) of SE Asia. Gerlach & Griffiths (2002) have since recorded *N. (I.) peilei* (as "*pelei*") from Aldabra, though again their specimen is difficult to ascribe to this species with certainty. Gerlach & Griffiths also record a *N. (I.) cf. rodriguezensis* (Connolly) from Aldabra and although the Jozani specimen resembles this one, it does not resemble Connolly's (1925a) original figure in the form of the parieto-palatal tooth. These species therefore probably need revision.

Nesopupa (Afripupa) bisulcata (Jickeli, 1873)
Fig. 13

Distribution Rora-Beit-Andu Plateau, Ethiopia (type locality; Adam, 1954) Zimbabwe and Democratic Republic of Congo (Adam, 1954); widespread in mainland East Africa (Verdcourt, 1983; Tattersfield *et al.*, 2001; Verdcourt, 2004); Jozani Forest (2000 survey).
Remarks The juvenile from Jozani Forest (2000) (Fig. 2e) resembles adult specimens from Mbudya Island near Dar-es-Salaam (1998) (Fig. 2f) in its size and sculpture. In turn this matches Adam's (1954) figure of *N. iota* (Preston) despite being even smaller. Adam later (1957) synonymised *N. iota* with *N. bisulcata*. Though differences between nominal species are detectable there has been less tendency to split *Afripupa* than *Insulipupa*; perhaps because of the continental rather than insular distribution.

CERASTIDAE (8; 2 EXCLUDED)

Edouardia conulina (von Martens, 1869)
Fig. 27

(not *Buliminus (Rhachis) conulinus* von Martens, 1878)
Buliminus cinereus Taylor, 1877 syn. by Verdcourt, 1981 (attributed to "Gibbons MS" by Taylor, 1877b
Distribution "Sesam, Insel Zanzibar" [Unguja; type locality of *E. conulina*] (von Martens, 1869); "Zanzibar" [Unguja, as type locality of *B. cinereus*] (Taylor, 1877b); "Zanzibar" [Unguja] and Pemba (Verdcourt, 1983).
Remarks This species has not yet been recorded from the mainland.

Edouardia tumida (Taylor, 1877) (attributed to "Gibbons MS" by Taylor, 1877a)
Fig. 28

Distribution "Zanzibar" [Unguja] and "Chapani Island" [islet off Unguja; type localities] (Taylor, 1877a); "Kenya, Tanzania & Zanzibar (coast)" (Verdcourt, 1983); Jozani Forest (2000 survey).
Remarks The three specimens in the type lot in BMNH are of three different species, as first noted by Connolly (1925b). One must be *E. tumida* and matches Taylor's figure and was designated lectotype by Connolly (1925b). The other two are labelled as *E. metula* (von Martens, 1895) and "not *tumidus* Gibbons MS". The "not *tumidus*" specimen is perhaps intermediate in form between the two. At present it is not possible to be sure whether all three occur on Zanzibar or whether one or more is wrongly localized and was later included in the lot. Verdcourt (1983) does not include Zanzibar in the distribution of *E. metula*. Three juvenile *Edouardia* from Jozani Forest (2000 survey) are probably *E. tumida* but are too small or young to discriminate from *E. metula* with certainty.

Note on the genera *Rachis, Rhachidina* and *Rhachistia*: species in these genera vary considerably in shell colour and pattern, are likely to have been overdescribed. As Herbert & Kilburn (2004) suggest, the species are in need of revision. It is not entirely clear which genus most of these species belong in so I follow Mordan's (1992) usage for the species treated by him.

Rachis punctata (Anton, 1839)
Fig. 29

Buliminus variolosus (Morelet) syn. by Connolly, 1928
Rhachis burtoi Bourguignat, 1889 syn. by Germain, 1918
Rhachisellus ledoulxi Bourguignat, 1889 syn. by Germain, 1918
Distribution "Zanzibar" [Unguja] and "Chapani Island" [islet off Unguja] (Taylor, 1877a and Gibbons, 1879); widespread and common along the coasts of many countries bordering the tropical Indian Ocean; introduced to Atlantic coast of Democratic Republic of Congo (Pilsbry, 1919).
Remarks According to Connolly, *B. variolosus* is a bandless form which occurs with banded *R. punctatus* (for instance, at Dar es Salaam). The two species of Bourguignat synonymised by Germain (1918) are from East Africa; Verdcourt (1983) keeps *R. burtoi* separate and notes its occurrence in Zanzibar and coastal Kenya, but having seen the type at MNHN I agree with Germain's synonymy.

Rhachidina braunsi (von Martens, 1869)
Fig. 31

Distribution "Sesam, Insel Zanzibar" [Unguja; type locality] (von Martens, 1869); widespread in East Africa (Verdcourt, 1983); Zanzibar (Bourguignat, 1889).
Remarks Verdcourt (1983) lists the following other names as varieties or synonyms: *bloyeti* Bourguignat; *dubiosa* Sturany; *hypostícta* von Martens; *quadricingulata* E. A. Smith; *lunulata* (von Martens) *cameroni* Bourguignat; *succincta* (von Martens) and *jouberti* Bourguignat. Several occur on "Zanzibar" [Unguja] according to Verdcourt (1983) but the validity of these forms is very questionable. Verdcourt (1983) also comments that *braunsi* may prove to be a junior synonym of *histrio* L. Pfeiffer, 1854, described from the Loyalty Islands where it must have been introduced. Mordan (1992) treated *histrio* in the genus *Rhachistia*.

Rhachidina melanacme (L. Pfeiffer, 1855)
Distribution Tette, Mozambique (type locality; Pfeiffer, 1855); Pangani, Tanzania and "Zanzibar" [Unguja] (Verdcourt, 1983); Zambia, Mozambique, and KwaZulu-Natal (Herbert & Kilburn, 2004).
Remarks Verdcourt (1983) suggests that this species may have been introduced to East Africa. However, Herbert & Kilburn (2004) suggest it may be conspecific with *Rhachidina usagarica* (E. A. Smith, 1890), which is widely recorded in East Africa (Verdcourt, 1983; Mordan, 1992).

Rhachidina mozambicensis (L. Pfeiffer, 1859)
Fig. 30

Rhachis spekii Bourguignat, 1879 syn. by Verdcourt, 1983 (as "*spekei* Bgt.")
Distribution Mozambique (type locality) (Pfeiffer, 1859); "Zanzibar" [Unguja] (Gibbons, 1879); coastal Kenya, coastal Tanzania, Zanzibar [Unguja] and Rukwa area [SW Tanzania] (Verdcourt, 1983).
Remarks Bourguignat later recorded *R. spekei* (1889) from the island and the mainland. Syntypes of *B. spekii* at MNHN also show a resemblance to *R. braunsi* (von Martens). Verdcourt (2000) did

not later treat this species in his list of coastal molluscs.

Rhachistia hildebrandti von Martens, 1878 (not *Buliminus (Conulinus) hildebrandti* von Martens, 1895; see Verdcourt, 1984)
Distribution Duruma, Kenya (type locality; von Martens, 1878) coastal Kenya, coastal Tanzania and "Zanzibar" [Unguja] (Verdcourt, 1983).
Remarks See Verdcourt (1984) for a history of nomenclature of this taxon. It was first described as a variety of *R. braunsii* (von Martens) and may need further critical evaluation.

Rhachistia picturata (Morelet, 1889)
Rachis trichroa von Martens, 1891 syn. by Verdcourt, 1983
Distribution "Mogadoxo, dans le Zanguebar" [the East African Coast, possibly Somalia] (type locality; Morelet, 1889); "Zanguébar" [the East African coast] (Bourguignat, 1889); "Kenya, Tanzania and Zanzibar (coast)" [Unguja] (Verdcourt, 1983).
Remarks None.

FERUSSACIIDAE (2; 1 EXCLUDED)

Cecilioides callipeplum (Connolly, 1923)
Fig. 21
Distribution Eusso Nyiro, Kenya (type locality) and Lorian Swamp, Kenya (Connolly, 1923); near Tana River, Kora, Kenya (Verdcourt, 1986); Jozani Forest (2000 survey).
Remarks Connolly (1923) introduced a Section *Micropeas* for species "distinct" from *Opeas* and with texture like *Cecilioides* but with longer whorls, with the suggestion that *Micropeas* may indeed belong in the latter. The single shell from Jozani resembles the types of and description of *O. callipeplum* (BMNH.1937.12) more than any other African taxon of which I am aware, despite being shorter and having one less whorl, and is a good match for the figures in Verdcourt (1986).

Cecilioides kalawangaensis Dartevelle & Venmans, 1951
Fig. 16
Distribution Kalawanga opposite Matadi, western Democratic Republic of Congo (type locality) (Dartevelle & Venmans, 1951); Jozani Forest (2000 survey).
Remarks The single shell from Jozani closely resembles the description and some paratypes of *C. kalawangaensis* (MRAC.106633). It also resembles *C. manensis* de Winter, 1990 from Man, Côte d'Ivoire (de Winter, 1990), but this is shorter and with a relatively taller aperture. It does not resemble any other species shown by Dartevelle & Venmans (1951), Connolly (1939) or Verdcourt (1983) types of some of which I have seen or photographed, including the Kenyan *C. virgo* Preston, 1911. Like *C. callipeplum* above, this species must be underrecorded. It may be spread by man.

"SUBULINIDAE" (8; 4 EXCLUDED)
Note: the Subulinidae are polyphyletic among the Achatinidae based on DNA sequence similarities (Wade *et al.*, 2001). Overlapping variation has caused confusion between species.

Subulina octona (Bruguière, 1881)
Fig. 32
Distribution "Insel Sansibar" [Unguja] (von Martens, 1897); "Bei Russago", Tanzania (Verdcourt, 1983).
Remarks Synanthropic and very widely introduced, probably originally neotropical (Pilsbry, 1905). The type locality is "Les Îles Antilles, specifically mentioning Guadeloupe and Saint-Domingue" (Cowie, 1998b). Verdcourt (1983) lists only the Bei Russago and Zanzibar records (the latter "fide von Martens") and does not later (2000) list the species. However, the species can be found easily near habitation in Dar-es-Salaam (pers. obs, 2004) and it may yet be spreading in E. Africa.

Subulina intermedia Taylor, 1877 (attributed to "Gibbons MS" by Taylor, 1877b)
Fig. 25
Distribution "Zanzibar" [Unguja; type locality] (Taylor, 1877b); Ukami and Usagara, Tanzania (Bourguignat, 1889) Kibwesi, Kenya (Verdcourt, 1983).
Remarks none.

Pseudopeas igembiense Connolly, 1923
Fig. 17
Distribution Igembi Hills, 6000ft, Kenya (type locality; Connolly, 1923); Jozani Forest (2000 survey).
Remarks Not recorded from elsewhere

(Verdcourt, 1983) but may have been confused with other *Pseudopeas* species.

Opeas delicatum Taylor, 1877 (attributed to "Gibbons MS" by Taylor, 1877b)
Figs. 23, 24

Distribution "Zanzibar" [Unguja] (Taylor, 1877b; type locality); Manyono, Uganda; Vipingo, Kenya; Amani, Tanzania; and Mnaji Moja, Zanzibar [Unguja] (Verdcourt, 1983); Jozani Forest (2000 survey)

Remarks Of the *Opeas* listed by Verdcourt (1983), *O. delicatum* in particular is marked out by the comment "? *Lamellaxis gracilis*". Small subulinids like these are so variable in shell characters (Naggs, 1994; Herbert & Kilburn, 2004) that they are difficult to discriminate even in sympatry. This is the case with the material from Jozani. This includes live individuals but they are too juvenile to allow comparison of the genitalia. Figs. 23, 24 and 26 illustrate some of the shell differences between *L. gracilis* and *O. delicatum*.

Opeas lamoense Melvill & Ponsonby, 1892
Fig. 22.

Curvella alabastrina Preston, 1911 syn. by Verdcourt, 1983

Curvella shimbiense Preston, 1910 syn. by Verdcourt, 1983 (treated as variety)

Distribution "Lamo, E. Africa" [probably Lamu, Kenya] (Melvill & Ponsonby, 1892; type locality); coastal Kenya, coastal Tanzania, and Zanzibar [Unguja] (Verdcourt, 1983); Shimba Hills, Kenya and Jilori Kenya "cf. Turi" (Verdcourt, 1983; as var. *shimbiense*) Jozani Forest (2000 survey).

Remarks Verdcourt (1983) notes *O. lamoense* is "vary close to *Curvella pertranslucens* [Preston, 1910] and var. *fallooni* [*pertranslucens* subsp. *fallooni* Connolly, 1923]". These may yet be synonyms, and I suspect there is little justification for maintaining infraspecific taxa in *O. lamoense* at present.

Lamellaxis (Allopeas) gracilis (Hutton, 1834)
Fig. 26

Opeas tangaense d'Ailly, 1910 syn. by Verdcourt, 1983

Distribution Coastal Kenya "cf. Turi"; Tanga and Uluguru Mts., Tanzania; and Zanzibar [Unguja] (Verdcourt, 1983); Mkulumusi caves, Usambara, Tanzania (d'Ailly, 1910; type locality of *O. tangaense*); widely introduced in the tropics (Pilsbry, 1905).

Remarks Verdcourt (1983) lists *L. gracilis* with the comment "many "*Opeas*" species may have to be included here" (see *O. delicatum* below). Verdcourt (2000) suggests it is restricted to "waste places".

Pseudoglessula subolivacea agg. (E. A. Smith, 1890)
Fig. 36

(*nom. subst*. for *Buliminus olivaceus* Taylor, 1877, preocc.; *B. olivaceus* was attributed to "Gibbons MS" by Taylor, 1877a)

Distribution "Bawri Island, Zanzibar, Channel" [off Unguja; type locality of *B. olivaceus*; Gibbons is said not to have found it on Unguja or "any of the other coral islands"] (Taylor, 1877a); coastal Kenya, coastal Tanzania, and Zanzibar [Unguja] (Verdcourt, 1983); Jozani Forest (2000 survey).

Remarks This species forms part of the *P. boivini-subolivacea* complex detailed by Verdcourt (1967). The complex ranges over most of E. and S. E. Africa in a variety of vegetated habitats. Germain (1918) recorded a single individual of *P. boivini* (Morelet, 1860) from Zanzibar, along with a series of *P. liederi* (von Martens, 1895) which I have seen at MNHN. Verdcourt (1967) also places *P. liederi* in the *P. boivini-subolivacea* complex. *Pseudoglessula* from Jozani Forest (2000) match von Martens's and Germain's description of *P. liederi* and are similar to Germain's specimens of *P. liederi* and NMW specimens (Bawri Island, ex Gibbons, NMW.1955.158.24239) of *P. subolivacea*. There is some apparently continuous variation between specimens in size, protoconch size and strength of sculpture. At least 58 species of this genus are named from East Africa (Verdcourt, 1967), some separable on shell morphology, but extensive collections in NMW suggest that shell characters vary. It is unclear how many species in this complex can be found coexisting at a site.

Homorus (Subulona) usagarica (E. A. Smith, 1890)
Figs 34, 35

Homorus usagaricus subsp. *monticulus* K. L. Pfeiffer, 1952

Homorus insularis Germain, 1918 n. syn.

Distribution Kidete, Tanzania (type locality of *usagarica*) and Usagara, Tanzania (Smith, 1890); Mombo, Usambara, Tanzania (d'Ailly, 1910, as *Homorus (Subulona) usagaricus*); "Zanzibar"

[Unguja] (Germain, 1918; type locality of *insularis*); between Marangu and Bismarck Hill, Kilimanjaro, Tanzania (K. L. Pfeiffer, 1952; type locality of subsp. *monticulus*)

Remarks H. insularis, recorded only from Unguja, is here synonymised with *H. usagarica*. I have examined the following material: 7 syntypes of *usagarica* BMNH.1890.7.16.121-6 (Fig. 35); six other specimens of *usagarica* NMW.1955.158.24240 from "Usagara"; a lot containing two newly located syntypes of *insularis* (Fig. 34) (MNHN, my det., from "Zanzibar" ex "M. Raffray, 1891"); holotype of *monticulus* SMF.96723 (digital photograph only); two other specimens from "Zanzibar" ex. Boivin, 1853 (MNHN, my det.); seven other specimens (plus one fragment of a shell) labelled "de Zanzibar" (perhaps meaning they were localized after collection) ex. Grandidier, 1864 (MNHN, my det.).

The elongate, many-whorled and flat-sided *H. insularis* is known only from Germain's (1918) description based on two shells from Unguja. The two MNHN specimens of *H. insularis* from Raffray fit the dimensions of the two specimens mentioned by Germain (1918) almost exactly so I am confident that they are the types. The Raffray label is authentic judging by other Germain/Raffray types at MNHN. However, the larger shell (Fig. 34) does not exactly match Germain's Figs. 27-28. Germain's drawing (67 x 10mm; ratio 6.7), are not in proportion with the dimensions given for the shell (34 x 6mm; ratio 5.67); it has been stretched or exaggerated to become taller and narrower. Germain's main criterion for separating *H. insularis* from *H. usagarica* was the length and length-width ratio. This may be a poor character: these dimensions are clearly variable in subulinids (e.g. Naggs, 1994).

H. usagarica was described by Smith (1890) as "very elongate with almost flat whorls". Although his Pl. V, fig. 17 approaches the dimensions given (37 x 7mm; ratio 5.28), none of the BMNH syntypes or NMW material attains this size. Slight variation in the length and tumidity of the whorls between these types and other specimens is no greater than the differences between the types and other specimens of *H. insularis*. The similarity can be seen in the specimen shown here (Fig. 35). Smith (1890) called attention to the slight crenulation on the suture "especially on the upper volutions", and this feature is present, albeit slightly less marked on *H. insularis*. The embryonic whorls of all this material, perhaps importantly, are of the same size and shape, and this distinguishes material of both taxa from the types of other E. African *Homorus* I have examined at BMNH. The sculpture on both *H. usagarica* and *H. insularis*, another character Germain used to distinguish them, is not describably different (50x magnification, light microscope). There are two remaining minor differences between the types and other material of the two species. These are the brown colour of the periostracum (of which only traces remain on the *H. usagarica* types) and the fact that some of the *H. usagarica* types are decollate. Whether this is "true" decollation that occurred during life or whether the shells are broken I am not certain; there is no obvious evidence of repair to the broken edges as there is in most decollate species (e.g. *H. amputatus* Pilsbry, 1919). Germain (1918) suggested another species, *H. lenta* (E. A. Smith, 1880) could be distinguished from *H. insularis* by being decollate where *H. insularis* was not. I do not think any of these characters are sufficient to discriminate *H. usagarica* and *H. insularis* and suggest that *H. usagarica* is a (slightly) variable species distributed in both Usagara and Unguja, and probably intervening areas. The fact that Pfeiffer (1952) described a *Homorus usagaricus* subsp. *monticulus* K. L. Pfeiffer, 1952 from Kilimanjaro can also be considered in support of the concept of *H. usagarica* as widespread and variable.

"ACHATINIDAE" (4; 4 EXCLUDED)

Overlapping polytypic variation and weathering of shells has meant most achatinids are greatly overdescribed. For coastal E. African species, Bequaert's (1950) shell-based revision and Mead's (1995) more modern study are useful. Herbert & Kilburn (2004) note that achatinid species seldom occur in sympatry in South Africa but this prediction is impossible to test in East Africa without a practical means of identification. I take this opportunity to include a few figures (Bequaert and Mead's figures are all black and white) as some reference for future workers on the Tanzanian islands. Further confusion is, unfortunately, likely to be caused by *A. zanzibarica* (see excluded species).

Achatina (Lissachatina) allisa Reeve, 1849
Fig. 43
A. iredalei Preston, 1910 syn. by Mead, 1995
A. albicans Bequaert, 1950 syn. by Mead, 1995
A. delorioli Bonnet, 1864 syn. by Mead, 1995
Distribution Shimba Hills, Kenya (type locality of *iredalei*; designated the type locality for *allisa* by Mead, 1995); "common to the East African coastal and adjacent areas between 2º – 7 º S latitude[…] has fingered its way into the interior via river valleys"; Mafia, Pemba, and "rich collections (MCZ) […] in Zanzibar" [Unguja] (Mead, 1995); "small islet between Bawri Island and Chapani" [off Unguja] (Gibbons, 1879); Jozani Forest (2000 survey).
Remarks Bequaert (1950) gives "Pfeiffer, 1865 [;] not of Reeve, 1849" as the authority of *allisa* and favoured the younger name *iredalei*. Bequaert (1950) notes that this ovoviviparous species (as *iredalei*) is relatively easily recognised by shell characters. Mead (1995) excludes the type locality of *albicans* ("West Africa") as erroneous.

Achatina (Lissachatina) eleanorae Mead, 1995
Fig. 46
Distribution Chole Island, SE of Mafia, Tanzania (type locality); Jibondo and Songo Songo Islands, S of Mafia, Tanzania; not yet recorded from Unguja, Pemba or the mainland (Mead, 1995).
Remarks Mead (1995) predicts this species is restricted to small islands between 7º–9ºS latitude in Tanzania, so it may not be expected on Unguja.

Achatina (Lissachatina) fulica agg. Bowdich, 1822
Fig. 45
A. fulica subsp. *hamillei* Petit, 1859
A. fulica subsp. *rodatzi* Dunker, 1852
A. letourneuxi Bourguignat, 1879
A. panthera von Martens, 1859 not Férussac, 1832
A. panthera var. *leucostyla* Pilsbry, 1904
A. panthera var. *nasimoyensis* Bourguignat, 1879
A. panthera var. *neumanni* von Martens, 1897
A. pantherina von Martens, 1897
(all syn. by Bequaert, 1950)
Distribution S Somalia (7º30'N) and Ethiopia to N Mozambique (17ºS) including "small islands off the East African coast, including Zanzibar [Unguja] and Pemba" (Bequaert, 1950; as subsp. *hamillei*); "Zanzibar" [Unguja] where it was "very numerous and generally diffused, being the only land shell that is so" (Gibbons, 1879); occurring "sparingly" with *A. fulica* on Zanzibar [Unguja] (Gibbons, 1879, as *A. rodatzi;* observation confirmed in Bequaert, 1950); Kisumu, W Kenya (Verdcourt, 1983); Chole Island, SE of Mafia, Tanzania (Mead, 1995); spread throughout the tropics and elsewhere (Mead, 1961); not noted in Jozani Forest (2000 survey).
Remarks It is remarkable that *A. fulica*, the world's heaviest terrestrial invertebrate pest, a food source and a popular pet, is so poorly characterized as a species. The original range is probably coastal E. Africa (Bequaert, 1950; Mead, 1961) but there is currently no practical guide to distinguishing indigenous populations from secondary reintroductions in the region, or indeed of being certain which of the introduced populations anywhere belong to *A. fulica* and which may be different species. This may have implications for pest management as well as the conservation of indigenous species of *Achatina* in various parts of Africa. Bequaert (1950) dealt with the problem by restricting the nominate subspecies *A. fulica fulica* to all the islands to which it was believed to have been introduced (e.g., Madagascar, Comoros, to New Guinea and Hawaii, etc.) while noting their great variability, suggesting it was derived from *A. fulica hamillei* by "insular isolation at a comparatively recent date". Mauritius was tentatively singled out as the possible type locality of *A. fulica fulica* by Bequaert (1950). Mead's (1961) handbook notes the variability of introduced populations but does not discuss their species identity, effectively treating them as an *A. fulica* aggregate and this is the term I use here. I suspect Emberton *et al.* (1997) did likewise when they suggested *A. fulica* was the most widespread species in their surveys of coastal Tanzania. The synonyms listed above were listed from the E. African coast by Bequaert (1950), who treated *A. panthera* records from "Zanzibar" as wrongly localized. Bequaert treated *hamillei* and *rodatzi* as E. African subspecies, distinguishable from the nominate subspecies thus: *hamillei* is usually larger than the nominate race and with a less concave suture; *rodatzi* is said to be the same shape as *hamillei* but white and with a more or less plain olive-yellow periostracum. He acknowledged that they "might perhaps be better sunk as synonyms". Verdcourt (1983, 2000) lists them together, with *A. fulica*

rodatzi as including *hamillei*. The observations of Gibbons (1879) and Bequaert (1950) suggest that *rodatzi* is a sympatric colour morph of *A. fulica hamillei* which may not require a name. The relationship between *A. fulica hamillei* and *A. fulica fulica*, however, may need further investigation.

Achatina (Lissachatina) reticulata L. Pfeiffer, 1845
Fig. 42

Distribution "Zanzibar" [Unguja] (Gibbons MS; record not published in Gibbons, 1879, however); Lindi Bay, Tanzania (Gibbons, 1879); near Lindi and various places on Unguja (Bequaert, 1950); Jozani Forest (2000 survey); Mkungwe Forest Reserve, Uluguru Mts., Tanzania (NMW unpubl. survey, 2003).

Remarks It seems unlikely that this spectacular and distinctive species is underrecorded, but so far it is known only from Unguja, Lindi and now Uluguru (NMW survey). Much of the material in Bequaert's exhaustive study was from "Zanzibar" without further locality; the type locality is simply "Africa" (Bequaert, 1950).

STREPTAXIDAE (16; 5 EXCLUDED)

Edentulina obesa (Taylor, 1877) (attributed to "Gibbons MS" by Taylor, 1877a)
Fig. 41

Ennea minor von Martens, 1869 (not Morelet, 1851) syn. by Bequaert & Clench, 1936a

Ennea zanguebarica (Morelet, 1889) syn. by Smith, 1894

Distribution "Bawri Island, Zanzibar" [off Unguja] (Taylor, 1877a; type locality); Magila, Usambara, and Pangani, Tanzania (Craven, 1880); "near lake Nyasa and between it and Dar es Salaam", Tanzania (Smith, 1881); "Kisemo in Ukuere", Tanzania (von Martens, 1891); Witu and Mangaea, Kenya (Smith, 1894); Derema in Usambara and Masai Steppe at Pangani R., Tanzania (von Martens, 1897); Kipatimu, Tanzania (Germain, 1916 as cited by Bequaert & Clench, 1936a); Malindi and Mombasa, Kenya and Tanga, Quiryana and Nguru Mts., Tanzania (Bourguignat, 1889); "Zanguebar" or coastal Tanzania (Bequaert & Clench, 1936a, for *zanguebarica*, noting that no type locality was specified); Mt. Mbololo, Taita Hills, Kenya; "summit of Mt. Umengo" [Taita Hills, Kenya]; Nyange, 3000ft, Uluguru Mts., Tanzania (Bequaert & Clench, 1936a); Songo Songo Island, Tanzania [off Mafia] and Pemba (Verdcourt, 1983); not noted in Jozani Forest (2000 survey).

Remarks Smith (1894) synonymised two other names with this species: *Ennea (Edentulina) bulimiformis* Grandidier, 1887 and *Ennea (Edentulina) grandidieri* von Martens, 1897. Bequaert & Clench (1936a) treat these as a single variety *E. obesa bulimiformis* with a narrower aperture, whose distribution includes the Usambara, Nguru and Uluguru Mts., Tanzania and Voi, Taita Hills, Kenya (Bequaert & Clench, 1936a). Verdcourt (1983) additionally lists coastal Kenya and coastal Tanzania as localities, but this variety has not yet been reported from the islands. Barker & Efford (2004) note that *E. obesa bulimiformis* was introduced, without establishment, from Kenya to Hawaii in 1957.

Edentulina ovoidea (Bruguière, 1789)
Fig. 44

Ennea (Edentulina) ovoidea var. *mayottensis* Dupuis & Putzeys, 1901 syn. by Bequaert & Clench, 1936a

Bulimus grandis Deshayes in Férussac, 1851 (not L. Pfeiffer, 1846) syn. by Bequaert & Clench, 1936a

Ennea tumida Morelet, 1860 syn. by Bequaert & Clench, 1936a

Edentulina affinis C. R. Boettger, 1913 syn. by Verdcourt, 1983

Edentulina affinis var. *gracilis* C. R. Boettger, 1913 syn. by Bequaert & Clench, 1936a

Distribution Mayotte (up to 1200m) and Anjouan, Comoros (Bequaert & Clench, 1936a; type locality of *ovoidea* not otherwise known); Madagascar (Bequaert & Clench, 1936a; as type locality of *grandis*); Kipatimu, Tanzania (Bequaert & Clench, 1936a; as type locality of *affinis* and *affinis* var. *gracilis*); Kilwa, Mt. Nguru, and various places in the Usambara and Uluguru Mts., Tanzania (listed by Bequaert & Clench, 1936a, as *affinis*); coastal Kenya, coastal Tanzania and "Zanzibar" [Unguja] (Verdcourt, 1983); Jozani Forest (2000 survey); deliberately introduced in 1970-1973 between Comoros islands, and from the Comoros to Madagascar and Réunion (Emberton, 1999; Barker & Efford, 2004, as *ovoidea*); introduced, without establishment, from "Kenya" to Hawaii in 1957 (Barker & Efford, 2004, as *affinis*).

Remarks Bequaert & Clench (1936) kept *affinis* (including its var. *gracilis*) separate from *ovoidea* on the basis of shell shape, while acknowledging that size and shape "vary greatly". They considered it a Tanzanian montane forest equivalent of *ovoidea*, which they said was known only from the Comoros with certainty. However, at least two of their listed localities for *affinis* (Kilwa and Kipatimu) [both Lindi Region, Tanzania] are in coastal lowlands. Verdcourt (1983) later listed *ovoidea* as "incl. *affinis*". These carnivorous snails have been deliberately spread beyond Africa as biological control agents and it may now be difficult to examine whether *affinis* was indeed a species allopatric to *ovoidea*.

Gonaxis denticulatus (Dohrn, 1878)
Fig. 38

Streptaxis ordinarius E. A. Smith, 1890 syn. by Thiele, 1911
Gonaxis ordinarius var. *obliquior* Haas, 1936 syn. by Verdcourt, 1983
Distribution Mombasa, Kenya (Dohrn, 1878; type locality); Mamboia, 4000-5000ft, Tanzania (Smith, 1890; type locality of *ordinarius*); mountains W. of Bumbuli, 1400m, W. Usambara Mts., Tanzania (Haas, 1936; type locality of var. *obliquior*); "Insel Sansibar" [Unguja] (von Martens, 1897, as *ordinarius*); Uluguru, Udzungwa, and other montane areas of Tanzania (NMW surveys, unpubl.); coastal Kenya and Tanzania (Verdcourt, 2000); not noted at Jozani Forest (2000 survey).
Remarks Von Martens (1897) treated *G. denticulatus* and *G. ordinarius*, recording only the latter from Unguja. He did not review *G. gibbonsi* Taylor, perhaps believing it was synonymous with *G. ordinarius*. Indeed, Verdcourt (1966) later expressed doubt that *G. denticulatus* was distinct from *G. gibbonsi*, but the issue remains unresolved.

Gonaxis gibbonsi Taylor, 1877
Fig. 37

Distribution "Zanzibar" [Unguja] (Taylor, 1877a; type locality); East Usambara Mts., Tanzania (Verdcourt, 1983); Taita Hills, Kenya (C. Lange, unpubl., 2001).
Remarks *G. gibbonsi* is the type species of *Gonaxis* Taylor, 1877 (monotypy). It is similar to *G. denticulatus* (Dohrn, 1878) and may prove to be conspecific, a matter which needs investigation (see above).

Gonaxis (Macrogonaxis) quadrilateralis (Preston, 1910)
Fig. 39

Distribution Shimbi Hills, Kenya (Preston, 1910; type locality); "Zanzibar" [Unguja] (Germain, 1918).
Remarks Germain (1918) claimed to have a small specimen of *Streptaxis craveni* E. A. Smith, 1880 from Unguja. He suggested that *Ennea quadrilateralis* Preston, 1910 (based on a "cotype" at MNHN) was likely to be the same species. However, Bequaert & Clench (1936c) note that *quadrilateralis* is supposed to have radial striae while *craveni* is smooth except at the suture. This explains Verdcourt's (1983) listing of Germain's record from Unguja under *Gonaxis quadrilateralis* marked with a "?". The two species should be further compared, but their published distribution so far is mutually exclusive. The distribution of *craveni* is: "on hills between the mouth of the river Tana and Mombasa" (Smith, 1880; type locality); Pangani and Derema, Usambara, Tanzania (Bourguignat, 1889); hills between the basins of Vouami and Kyngani, Kondoa, Usagara, Tanzania (Bourguignat, 1889); Taita Hills, Kenya and coastal Kenya (Verdcourt, 1983).

Gulella (Paucidentina) baccata (Preston, 1913)
Fig. 57

Distribution Urguess, [Matthews Range], Kenya (Preston, 1913; type locality); Bunduki, 1300m, 1500m and 1800-1950m, Uluguru Mts., Tanzania (Adam, 1965); Jozani Forest (2000 survey).
Remarks This species has a relatively simple apertural morphology which may vary. The type illustrated by Preston (1913) shows a small baso-columellar denticle, as do the Uluguru specimens identified and figured by Adam (1965). The denticle is very small in the Jozani material (2000). It is also likely that the species is closely related, if not synonymous with *G. pervitrea* (Preston, 1913), whose distribution is remarkably similar: "Forests N. of Mt. Kenia" (Preston, 1913; type locality); Mt. Kenya, Kenya and Uluguru Mts., Tanzania (Verdcourt, 1983). Verdcourt (1983) also notes the similarities of a species from Pienaar's Heights, Tanzania to *baccata* and of *G. mweruensis* Preston, 1913, from Meru, Kenya and the Nyambeni Hills, Kenya to *pervitrea*. The Jozani record is the first of any of these species occurring in lowland forest.

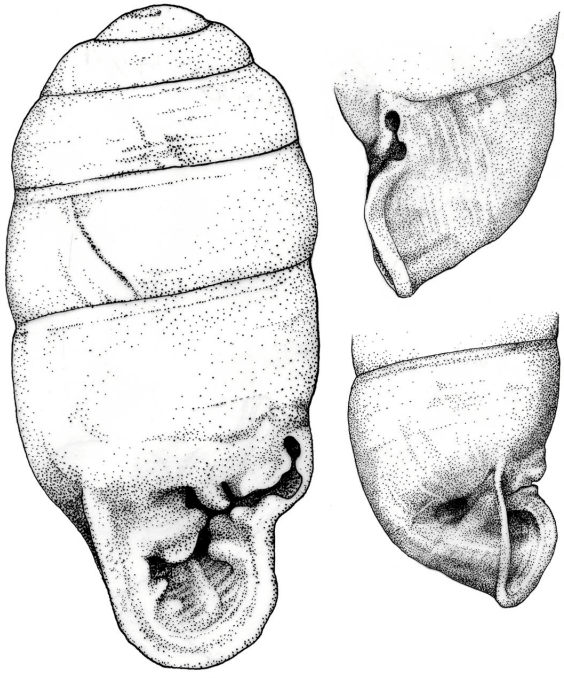

Fig. 60 *Gulella tracheia*, ***sp. n.***, holotype, NMW.Z.2004.014.00001 (h3.30mm)

Gulella jod (Preston, 1910)
Fig. 50

Distribution Shimba Hills, Kenya (Preston, 1910; type locality); many other forest localities in East Africa (NMW, unpubl. data from surveys 1994-2004); Jozani Forest (2000 survey).

Remarks Evidently very underrecorded but readily recognised by its size, shape, dentition (seven teeth) and the forward-pointing projection in the middle of the palatal wall when seen from the side. *Gulella hildae* van Bruggen, 2001 from Mt. Mulanje, Malawi is likely to be a synonym although the teeth differ slightly from the type of *jod*. A similar species is now known from the Comoros (I. Muratov, pers. comm., 2005).

Gulella minutissima (Thiele, 1911)
Fig. 51

Distribution "Sansibar" [either Unguja or the E. African coast] (Thiele, 1911; type locality); "Zanzibar" [Unguja] (Verdcourt, 1962) not noted in Jozani Forest (2000 survey).

Remarks This species is a putative Unguja endemic but its identity is not certain. It was described from a specimen in the Hamburg Museum labeled "Sansibar". The whereabouts of any types is unknown and they were probably destroyed at Hamburg during the 1939-1945 war (B. Hausdorf, pers. comm.). Verdcourt (1962) noted this species was recollected by "Ostheimer *et al*." in 1957 so there may be specimens at ANSP or NMK. Thiele noted the species' similarity to *Ennea columella* E. A. Smith, 1903 (type locality: Mau Escarpment, Kenya). Adam (1965) noted a similarity to *G. olkokolae* Adam, 1965 (type locality: Mt. Meru, Tanzania) and to the widespread *G. jod* (see above). These all differ from *minutissima* in the number of teeth: *minutissima*, 3; *jod*, 7; *columella*, 4; *olkokolae*, 4. Verdcourt (1983, 2000) had no data to add on *minutissima* other than to suggest that it may be a bushland species. It thus appears to be a relatively distinctive species that has not been recorded from the mainland.

Gulella peakei continentalis van Bruggen, 1975
Fig. 54

Distribution Lake Sibayi area, Tongaland, South Africa (van Bruggen, 1975b; type locality of *continentalis*); Maputaland, South Africa, and almost certainly into Mozambique (Herbert & Kilburn, 2004); Tororo, Uganda (NMS specimen, Peile collection, unpubl.); Udzungwa Mts. and Uluguru Mts., Tanzania (NMW, unpubl. surveys); Jozani Forest (2000 survey).

Remarks Evidently very widely distributed and variable, although very distinctive. Van Bruggen (1975a) described *peakei s.s.* from Quaternary fossils, Middle Island (Ile Malabar), Aldabra and later (1975b) provided evidence for a morphological discontinuity with the newly discovered continental subspecies. The Aldabran subspecies was said to be extinct and the result of a short-lived introduction by passive dispersal (rafting) (van Bruggen, 1975b). Van Bruggen (1975a) also notes that "a few of the species enumerated by Morelet from the Comoros, such as [*Gulella*] *minuscula* Morelet, 1877 […] superficially resemble *G. peakei*, but never show the peculiar spaced lamellae on the whorls", having instead only close-set striae. In fact the type of *G. minuscula* (BMNH.1893.2.4.87) shows more of a resemblance to *G. radius* (see below). I mention this because I can add that the type of the Comoran *G. cryptophora* (Morelet, 1881) (BMNH.1893.2.4) *does* in fact differ from *peakei* in the way outlined by van Bruggen above. Notwithstanding the difference in sculpture, I suspect there may be some phylogenetic relationship between *G. cryptophora* and the two subspecies of *G. peakei,* probably of

a similar nature to that between *G. radius* and *G. minuscula*.

Gulella radius (Preston, 1910)
Fig. 54

Distribution Shimba Hills, Kenya (Preston, 1910; type locality); coastal Kenya and Dar es Salaam, Tanzania (Verdcourt, 1983); Udzungwa Mts. and Uluguru Mts., Tanzania (NMW, unpubl. surveys); Mbudya Island, Tanzania (NMT, unpubl. survey, 1998); Jozani Forest (2000 survey).

Remarks Like *G. peakei continentalis* this is a widespread and variable but distinctive species. *G. minuscula* of the Comoros is a possible close relative of *G. radius* (see above), as is *G. browni* van Bruggen, 1969, of Mozambique and north-eastern South Africa (Herbert & Kilburn, 2004).

Gulella sexdentata (von Martens, 1869)
Fig. 58

Gulella laevigata var. *sexdentata* von Martens, 1869 (not Taylor, 1880)

Ennea hanningtoni E. A. Smith, 1890 syn. by Germain, 1935

Distribution "Sesam, Insel Zanzibar" [Unguja] von Martens, 1869 (as type locality of var. *sexdentata*); "Zanzibar" [Unguja] (Germain, 1918); very widely distributed from KwaZulu-Natal north to Tanzania, but not yet recorded from Kenya or Uganda (van Bruggen & van Goethem, 1997). not noted in Jozani Forest (2000 survey).

Remarks *G. sexdentata* occurs widely in both highland and lowland areas, in forests and sometimes in more open habitats (van Bruggen & van Goethem, 1997; Verdcourt, 2000). The name *laevigata* (Dohrn, 1865), used by both von Martens (1869) and Germain (1918) for Unguja records, is now only to be applied to a species that occurs near Lake Nyasa/Lake Malawi (van Bruggen & van Goethem, 1997).

Gulella streptostelopsis van Bruggen, 2007
Fig. 52

Distribution Below Mulunguzi Dam, Zomba Plateau, S. Malawi (type locality) and several other sites in Malawi (van Bruggen, 2007); Jozani Forest (2000 survey).

Remarks This species was described while the present paper was in press. Van Bruggen (2007) deals with species from E. Africa that could be considered similar. The specimens from Jozani resemble the types in a many respects, although the shell is a little thicker and there is a noticeable slight deviation of the columellar axis. Undescribed material that may represent one or more similar species has been collected at other forest sites in Tanzania (NMW, unpubl.) but this requires further examination. I. Muratov (pers. comm., 2005) notes the presence of a similar species on the Comoros. Indeed, van Bruggen (2007) suggested that this species was unlikely to be endemic to Malawi and was likely to be recorded from neighbouring countries. Thus, the apparent discontinuity between the Malawi ranges and the Jozani record is likely to be due to under-recording of this very small species.

Gulella tracheia sp. n.
Figs 53, 60

Description Shell small (height 3.05mm to 3.70mm x width 1.20mm to 1.45mm) and barrel-shaped, of 5.5 to nearly 6 whorls. Intraspecific variation in shells apparently slight. Penultimate whorl and body whorl together comprise about 60% of total height. Aperture comprises about 30% of total height. Peristome thickened and reflected, particularly in palatal and columellar part. Body whorl constricted and columella and aperture displaced to the left. Apertural dentition strongly developed and aperture highly constricted/divided: most characteristic feature a complex parieto-palatal sinus formed between a parieto-palatal lamella and palatal tubercles. The outer edge of this sinus is constricted in three places, dividing the lumen into three parts, two of which form an hourglass or keyhole shape. The lamella forming the sinus is directed to the right to face the living animal's right-hand side (assuming the shell is carried in the same orientation as similar species). Other dentition: one palato-basal lamella, entering fairly deeply. Two basal lamellae entering fairly deeply. Columellar process thick and deeply-set, one central lamella entering across it giving a tripartite appearance. One parietal lamella, entering fairly deeply, adjacent to the parieto-palatal lamella. Outside of palatal wall deeply and broadly excised corresponding to the palato-basal lamella and palatal tubercles inside. Outside of basal wall deeply and narrowly excised corresponding to a basal lamella inside. Umbilicus tubular, opening into the hollow columella and partly into columellar process. Shell surface smooth, without ribs or other major sculpture except on outer palatal

surface of last quarter of body whorl, where irregular widely-spaced ribs are present. Shell texture finely granular (x50 magnification under light) on adult and nepionic whorls, coarser on peristome. Extent of nepionic whorls not clearly demarcated by sculpture. Shell coloured white or clear; extent and nature of periostracum not discernable. Other anatomy currently unknown. Body colour pale yellowish-orange, optic tentacles orange.

Derivation of name From Greek "*tracheia*", the windpipe; with reference to the constricted aperture and possible function of the sinus.

Holotype (NMW.Z.2004.014.00001) 3.30mm x 1.30mm, 5.5 whorls. Freshly dead adult shell with animal retracted and dried, found in leaf litter in Jozani Forest, Unguja Island, Zanzibar, Tanzania (6º15'S, 39º24'E), 12 March 2000 (C. Ngereza, M. B. Seddon & P. Tattersfield).

Paratypes Paratype 1 (NMT) 3.70mm x 1.30mm, nearly 6.0 whorls. Empty subadult shell, slightly broken (collection data as holotype). Paratype 2 (NMW.Z.2004.014.00002) 3.05mm x 1.30mm, 5.5 whorls. Empty adult shell, slightly broken (collection data as holotype but date 11 March 2000). Paratype 3 (NMW.Z.2004.014.00003) 3.10mm x 1.45mm, 5.5 whorls. Freshly dead adult shell with animal retracted (collection data as holotype). Preserved in 96% ethanol. Paratype 4 (NMW.Z.2004.014.00004) 3.20mm x 1.20mm, 5.5 whorls. Freshly dead subadult shell with animal retracted (collection data as holotype). Preserved in 70% ethanol (methylated, with 5% propylene glycol). Paratype 5 (NMT) 3.05mm x 1.25mm, ?5.5 whorls. Empty subadult shell, broken (collection data as holotype but date 11 March 2000).

Other material Two other specimens from two Forest Reserves in mainland Tanzania: one freshly dead adult shell with animal retracted (NMW.Z.2003.001.00001). Sieved from leaf litter at 700m elevation in Mwanihana Forest Reserve, Udzungwa Mts. National Park, Iringa Region, Tanzania (7º8S, 36º86'E) January 2003 (C. Ngereza, B. Rowson, M. B. Seddon & P. Tattersfield) (temporary morphospecies name was "G. complex sinus"). One freshly dead adult shell with animal retracted (NMW.Z.1997.007.00001). Sieved from leaf litter at 1050-1300m elevation in Sali Forest Reserve, Mahenge Mts., Morogoro Region, Tanzania (8º57'S, 36º40'E). 5 February 1997 (C. Ngereza, M. B. Seddon & P. Tattersfield) (temporary morphospecies name was "G. sp. X close to PT sp. V").

Distribution Jozani Forest (type locality); Udzungwa Mts. and Mahenge Mts., Tanzania. This makes it a coastal forest species otherwise known only from the Eastern Arc mountain forests, albeit at low elevations.

Remarks This species is readily recognised, even as a subadult, by the complexity and orientation of the sinus and the other dentition. However, it is part of a group of E. African species, all around 3mm long, with phenetically somewhat similar shells and dentition. All of these are thus far known only from forests or other well-vegetated areas. *G. malasangiensis* (Preston, 1913) is the most similar but has a less complex sinus and different columellar dentition. *G. intradentata* (Preston, 1913) has a less complex sinus, no minor parietal lamella, different columellar dentition and no basal dentition. *G. bomolensis* Verdcourt, 1953 is similar to *G. intradentata* but again the sinus is different to *G. tracheia*. *G. iridescens* (Preston, 1913), described by Verdcourt (1953) as similar to *G. bomolensis*, is the least like *G. tracheia*. It is closer to the variable *G. gwendolinae* (Preston, 1910), of which numerous subspecies have been proposed. *G. gwendolinae* and some of the species just mentioned were considered to form a Section *Molarella* by Connolly (1922b) based on the more or less bifid columellar dentition. However, Verdcourt (1962) considered this artificial; it is unlikely to represent a clade. Mention should also be made of two other E. African forest species: *G. intrusa* Verdcourt, 1956 differs from *G. tracheia* in its much larger size, shape, in having fine radial sculpture and in having different dentition. Together with the (otherwise dissimilar) *G. cuspidata* Verdcourt, 1962 these are the only E. African *Gulella* I am aware of that have a sinus that resembles that of *G. tracheia.* Perhaps this feature has an adaptive value. It could allow air to the pulmonary cavity while the body is retracted (perhaps during resting periods) or extended (perhaps during feeding). This is not to say that the primary function of the apertural dentition in these species is not to deter arthropod natural enemies, limit desiccation or indeed any of the other functions that have been proposed.

Gulella (Pliciglulella) vicina (E. A. Smith, 1899)
Fig. 55

Ennea sambourouensis Dautzenberg, 1908
Ennea adelpha Preston, 1913
Gulella (Pliciglulella) salutationis Connolly, 1922
Gulella (Pliciglulella) bistriplicina Pilsbry, 1919
Gulella (Pliciglulella) mediafricana Pilsbry, 1919
(all syn. by Verdcourt, 1983)

Distribution Mt. Chiradzulu, 5000ft, Zomba Plateau, Malawi (Smith, 1899; type locality); between Masaka & Entebbe, SW Uganda (Preston, 1913; type locality of *adelpha*); Dar es Salaam, Tanzania (Connolly, 1922b; type locality of *salutationis*); Samburu, Kenya (Dautzenberg, 1908; type locality of *sambourouensis*); Penge, Ituri Forest, Democratic Republic of Congo (Pilsbry, 1919; type locality of *bistriplicina*); Beni, Semuliki River, Democratic Republic of Congo (Pilsbry, 1919; type locality of *mediafricana*); Voi, Kenya and Laikipia Plateau, Kenya (Connolly, 1922. as *sambourouensis*); Mfwangano Island, Kenya and "Tanzania" (Verdcourt, 1983, as *vicina* subsp. *vicina*); Jilori, Kenya, E. Usambara Mts., Tanzania and Lake Jipe, Tanzania (Verdcourt, 1983, as *vicina* subsp. *vicina* f. *sambourouensis*); perhaps near Kericho, Kenya (Verdcourt, 1983, as *vicina* subsp. *mediafricana*); N.W. of Gulu, Kayo Mts., Uganda and Guruguru Hills, Uganda (Verdcourt, 1983; as *vicina* subsp. *bistriplicina*); Jozani Forest (2000 survey).

Remarks Verdcourt (1983) treats the above synonyms as subspecies of *vicina*, with the exception of *sambourensis* which he treats as an infrasubspecific form of *vicina*. Each infraspecific taxon shows some difference in shell morphology (van Bruggen & van Goethem, 1997). The triplicate columellar process of the 4 specimens from Jozani Forest (2000) is much less deeply set than in some of these subspecies, creating a resemblance to *G. enneodon* (Connolly, 1922a) (type locality: district N. of Macequece, Mozambique).

Streptostele (Raffraya) acicula (Morelet, 1877)
Figs 47, 48

Ennea taylori Gibbons, 1879 n. syn.

Distribution Anjouan, Comoros (Morelet, 1877; type locality); Comoros; Aldabra; Nossi Bé, Madagascar; Amirantes; Mahé and Silhouette, Seychelles; Réunion; Mauritius; Rodriguez; Farquhar Atoll (distribution reviewed by van Bruggen, 2002); "Zanzibar" [Unguja] (Gibbons, 1879; type locality of *taylori*); perhaps Usambara Mts., Tanzania (von Martens, 1897, as *taylori*); Jozani Forest (2000 survey).

Remarks This species is distributed so widely on W. Indian Ocean islands it is strange that it has not yet been recorded from the E. African coast, whether naturally or as an introduction. I think the Jozani specimens represent *S. acicula* and also that *E. taylori* Gibbons is also referable to this species. Gibbons gives no figure, and the whereabouts of the type are unknown, but Verdcourt's (1981) placement of *taylori* in *Streptostele* is evidently correct judging by the description and the cited dimensions. However, there is cause for further comment. Gibbons said that *taylori* was "allied" to *Ennea bicolor* (Hutton, 1834) "of the Mauritius", a statement that was probably inspired by Morelet (1877) who said much the same thing in his description of *acicula*. This may explain why von Martens (1897) dealt with this species in "*Ennea (Paucidentina)*" (now in *Gulella*) rather than in *Streptostele*. The other species in his "*Paucidentina*" are *E. curvilamella* Smith, 1890 and *E. galactochila* Crosse, 1885, which have never been referred to *Streptostele*. *E. bicolor* is probably of Indian origin and is now usually referred to *Gulella* (Naggs, 1989). Incidentally, Naggs (1989) notes that *G. bicolor* has been recorded only once from E. Africa (Mombasa, Kenya) in 1964; the species is not listed by Verdcourt (1983, 2000).

Streptostele (Raffraya) bawriense (Pilsbry, 1905)
Fig. 49

(*nom. subst*. for *Stenogyra lucida* Gibbons, 1879 not *Opeas lucida* (Poey, 1851))

Distribution "Bawri Island, Zanzibar" [off Unguja] (Gibbons, 1879; type locality).

Remarks Moved by Pilsbry to *Opeas* (now under Subulinidae) this species required a new name. Verdcourt (1981, 1983, 2000) considered it a *Streptostele*. It may be a subadult *Streptostele* (perhaps *S. acicula*) but more material from the type locality would be required to resolve its status.

CHAROPIDAE (1)

Trachycystis lamellosa K. L. Pfeiffer, 1952
Fig. 15

Distribution Near Momella Farm, Mt. Meru, Tanzania (type locality; Pfeiffer, 1952); Teita Hills (C. Lange, unpubl., 2001); Jozani Forest (2000 survey: 1 specimen).

Remarks There is no *Trachycystis* with which

I can associate this specimen that does not imply a range or habitat extension; however, these small snails are underrecorded. Verdcourt (1983) lists no *Trachycystis* from coastal areas, and later (2000) lists only the very different *T. ariel* (Preston, 1910) from the coastal forests. The shape, size and sculpture of the Jozani specimen (1.8mm wide) resemble to some extent Pfeiffer's (1952) photograph of the holotype of *T. lamellosa*, but also *T. imitata* (E. A. Smith, 1903) (a synonym of T. *abyssinica* (Jickeli) according to Verdcourt, 1993). The latter are distributed in highland forests of Kenya and Tanzania (Verdcourt, 1983; 1993). The prospect of morphological variability in the E. African species has not been addressed as far as I know.

AGRIOLIMACIDAE (1)

Deroceras reticulatum (O. F. Müller, 1774)

Distribution Originally Palaearctic; introduced extremely widely. Ellis (1969, p. 257) lists "Zanzibar" [perhaps Unguja] among the areas to which this pest has been introduced.

Remarks Herbert & Kilburn (2004) note that *Deroceras* spp. are invasive in rural areas of South Africa, but also that few records are confirmed by dissection. As the only record from E. Africa so far, Ellis' record should be regarded as possible but unconfirmed.

EUCONULIDAE (2)

Afroguppya rumrutiensis (Preston, 1911)
Fig. 14

Thapsiella opposita Preston, 1912 syn. by Verdcourt, 1960

Dupontia sp. in Gerlach & Griffiths, 2002 n. syn.

Distribution Between Rumruti and Mt. Kenya, Kenya (type locality) and Rumruti, Laikipia Plateau, Kenya (Preston, 1911); Mt. Kinangop, Aberdare Mts., Kenya (Preston, 1912; type locality of *opposita*); various Kenyan highland localities and Mkuzi, Lushoto, W. Usambara Mts., Tanzania (Verdcourt, 1960); several other forest localities in Kenya and Tanzania (NMW, unpubl. surveys); Mozambique, Malawi, Zimbabwe, Zambia and South Africa (Herbert & Kilburn, 2004); Grande Terre, Aldabra (as *Dupontia* sp.; Gerlach & Griffiths, 2002); Jozani Forest (2000 survey).

Remarks Verdcourt (1960) clarified the identity and placement of this species, which has since been recorded very widely in various types of habitat (Verdcourt, 1960; Herbert & Kilburn (2004). Verdcourt (2000) did not however record it from coastal E. Africa. The Jozani shells (6) are rather low-spired, with a peripheral angle not as keeled as the specimen illustrated by Herbert & Kilburn (2004). Gerlach & Griffiths (2002) illustrate a *Dupontia* sp., (Helicarionidae) from Grande Terre, Aldabra, which I have examined (NMW.Z.2002.027.00002). I believe this comes within the variation of *A. rumrutiensis* (it still has traces of the sculpture). These authors suggest there is a similarity to other *Dupontia*, so perhaps the two genera should be compared. The relationship with *Afroguppya quadrisculpta* (Connolly, 1939), also recorded widely and from the E. African coast (Tattersfield, 1998; Lange & Mwinzi 2003) may also need further investigation.

Afropunctum seminium (Morelet, 1873)

Helix zanguebarica Craven, 1880 syn. by Verdcourt, 1963a

Thapsiella connollyi Preston, 1912 syn. by Verdcourt, 1963a

Afropunctum mermodi Haas, 1934 syn. by Verdcourt, 1963a

Distribution Gabon (type locality; de Winter & van Bruggen, 1992); throughout sub-Saharan Africa, and as quaternary fossils in Chad (Verdcourt, 1981; de Winter & van Bruggen, 1992); "Zanzibar" [Unguja] (Verdcourt, 1963a; said to be collected by Gibbons, though not mentioned by Gibbons (MS, 1879) or Taylor (1877a, b, 1880)); not noted in Jozani Forest (2000 survey).

Remarks Like *Afroguppya rumrutiensis*, *Afropunctum seminium* is found in very widely in a variety of habitats (de Winter & van Bruggen, 1992). *Afropunctum seminium* differs from *Afroguppya rumrutiensis* in the radula, genitalia and lung. Conchologically, they are relatively similar, though the former species has a relatively taller shell, more whorls, and the radial sculpture on the upper side of the whorls is relatively stronger (see de Winter & van Bruggen, 1992).

HELICARIONIDAE (1)

Note on Helicarionidae, Ariophantidae and Urocyclidae in E. Africa: the status and content of these families, especially as regards the African fauna, is the subject of disagreement. Verdcourt (e.g., 1983) treats most taxa in Urocyclidae with only *Kaliella* in Helicarionidae and only *Sitala* in Ariophantidae. Schileyko (2002) has Verdcourt's Urocyclidae as Urocyclinae in Ariophantidae, has *Sitala* in Ariophantidae, and *Kaliella* in Euconulidae. Herbert & Kilburn (2004) have *Kaliella* in Helicarionidae and a Urocyclidae comparable to that of Verdcourt (1983). Although Schileyko's classification goes beyond Africa the majority of shelled African species remain uninvestigated anatomically. I follow Herbert & Kilburn (2004), with *Sitala* in Ariophantidae as per Verdcourt (1983).

Kaliella barrakporensis (L. Pfeiffer, 1854)

K. consobrina Preston, 1912 syn. by Verdcourt, 1983

K. kigeziensis Preston, 1912 syn. by Verdcourt, 1983

Distribution Barrakpore, India (type locality; Pfeiffer, 1854); S., E. and Central Africa, Madagascar, and India (Herbert & Kilburn, 2004); Comoros (Fischer-Piette & Vukadinovic, 1974); many localities in E. Africa (NMW surveys, unpubl.); Jozani Forest (2000 survey).

Remarks Verdcourt (2000) does not list this species from the coastal forests. The date of authorship is sometimes given as "1852" in the literature.

ARIOPHANTIDAE (1)

Sitala jenynsi (L. Pfeiffer, 1845)

Distribution "Zanzibar" [Unguja] (Germain, 1918); reviewed by Verdcourt (1963b) as "essentially a species of the coastal strip", including Marafa, Kilifi, Kenya; many coastal localities in Tanzania; various places on "Zanzibar" [Unguja]; and Querimba, Mozambique (Verdcourt, 1963b); Jozani Forest (2000 survey).

Remarks Verdcourt (2000) notes that this is a species of open areas, scrub, woodland and plantations, but not forest.

UROCYCLIDAE (6; 6 EXCLUDED)

Thapsia curvatula von Martens, 1897

Fig. 4

Distribution Near Tegetero, Uluguru; Derema, Usambara; and "Kitohaui", Tanzania (von Martens, 1897; type locality not specified); Kigoma area, Tanzania and "Zanzibar" [Unguja] (Verdcourt, 1983); coastal E. Africa, in forests (Verdcourt, 2000); Jozani Forest (2000 survey).

Remarks Work on *Thapsia* is effectively stalled pending a thorough revision. The species have very similar shells that are difficult to identify (e.g. see Verdcourt, 2004), despite being relatively abundant in forest and woodland. Bourguignat (1889) commented that the only "*Tapsia*" (*Thapsia)* he knew of "du Zanguébar" was *Tapsia leroyi* Grandidier, 1887. This may have meant the E. African coast rather than Unguja, which Bourguignat calls "Ile Zanzibar" or "Zanzibar". Verdcourt (1983) records *T. curvatula* from "Zanzibar" [Unguja] while noting that it is perhaps a synonym of *T. leroyi*, which has priority. Jozani Forest specimens certainly resemble those of both *curvatula* and *leroyi* in size, shape and sculpture. I have not yet been able to compare the types, so it would not be wise to synonymise them here.

Trochonanina bloyeti Bourguignat, 1889

Fig. 7

Distribution Near Kondoa, Usagara, Tanzania (Bourguignat, 1889; type locality); "Zanzibar" [Unguja] (Germain, 1918).

Remarks Both Bourguignat (1889) and Germain (1918) regarded this species as very distinct. Having seen a syntype (holotype?) at MNHN I am not convinced that the slight shape and slight sculptural differences from *T. mozambicensis* (see below) are any more than superficial but reserve judgement on the issue until more data is available. It was kept up as a species by Verdcourt (1983, 2000) and there are as yet no other records.

Trochonanina mozambicensis (L. Pfeiffer, 1855)

Fig. 6

Nanina mossambicensis var. *albopicta* von Martens, 1869 (description as var.)

T. anceyi Bourguignat, 1885 syn. by von Martens, 1897

Distribution Tette, Mozambique (type locality;

Pfeiffer, 1855); Uganda, Kenya, and widespread in Tanzania (Verdcourt, 1983); central and S.E. Africa (Herbert & Kilburn, 2004); "Zanzibar" [Unguja] and "Chapani" [off Unguja] (Gibbons, 1879); "Zanzibar" [Unguja] (Germain, 1918; as both *mozambicensis* and *albopicta*); "Zanzibar" [Unguja] and Pemba (Verdcourt, 1983, as var. *mozambicensis*); "Zanzibar" [Unguja] (Verdcourt, 1983, as var. *albopicta*).

Remarks There are numerous named taxa such as *T. bloyeti* (see above) whose differences from *T. mozambicensis* have perhaps been overstated. Several *Trochonanina* reviewed in Bourguignat (1889) have this problematic status and some are not treated in Verdcourt (1983) (see Excluded species). Verdcourt (1983) said of this species: "[there are] numerous records but much misidentified and circumscription needs revising". Until this is done there is no way of addressing the status of a supposed variety like var. *albopicta*. Germain (1918) gave it specific status on Unguja but not long afterwards (1920-1923) treated it as a variety. Gibbons (1879) described the Unguja and Chapani shells as a small pale form with a thin shell, brown spiral band and small umbilicus from Unguja. A specimen in NMW from "Zanzibar" and bearing a manuscript name of Ancey conforms to this description. Verdcourt (1983) suggests that var. *albopicta* is mainly recorded in the N.E. of Tanzania and from coastal Kenya.

Elisolimax roebucki (Simroth, 1910)

Distribution "Ile de Pemba" (van Goethem, 1977; type locality).

Remarks Van Goethem (1977, p.241) expressed a doubt that this was a good species, noting a similarity to his *Elisolimax* "sp. B" from Moheli, Comoros. He also (p.244) suggested there was likely to be some synonymy in the genus which he did not have material to investigate.

Pembatoxon insulare van Goethem, 1975

Fig. 40

Distribution Pemba (van Goethem, 1975; type locality); Jozani Forest (2000 survey).

Remarks Three dissected individuals from Jozani agree with van Goethem's description in all respects including the form of spermatophores. *Pembatoxon* van Goethem, 1975 is the only terrestrial mollusc genus that is endemic to the Tanzanian islands, though further collecting may show that it occurs on the mainland.

Trichotoxon heynemanni Simroth, 1888

1977

T. voeltzkowi Simroth, 1910 syn. by van Goethem

Distribution Democratic Republic of Congo (van Goethem, 1977); S. Uganda; coastal and highland Kenya; E. Usambara Mts. and Uluguru Mts., Tanzania (Verdcourt, 1983); Pemba (Simroth, 1910; type locality of *voeltzkowi*).

Remarks Van Goethem (1977) lists a further 13 E. African synonyms in his revision of this species.

SUCCINEIDAE (2)

Quickia concisa (Morelet, 1848)

Fig. 20

Distribution Along the river Gaboon (Pilsbry, 1919; type locality); Democratic Republic of Congo (Pilsbry, 1919); Mayotte, Comoros (Fischer-Piette & Vukadinovic, 1974); Baringo, Kenya and coastal Kenya; "Zanzibar" [Unguja], Sierra Leone, Cameroon, Gabon, Sao Thome, Angola, Seycheles, Réunion, Mauritius, Rodrigues (Patterson, 1975); Kigoma, Tanzania; and "Zanzibar" [Unguja] (Verdcourt, 1983); Jozani Forest (2000 survey).

Remarks Generic placement in this case follows Verdcourt (1983, 2000). Gibbons (MS) recorded a "*Succinea ventricosa*" from Unguja but this was never published; it may be referable to this species.

"Succinea" pseudomalonyx Dupuis & Putzeys, 1901

Fig. 33

Distribution Mwana Milongo, Democratic Republic of Congo (Pilsbry, 1919; type locality); "Zanzibar" [Unguja] (Verdcourt, 1983).

Remarks Generic placement in this case follows Verdcourt (1983, 2000), who applies inverted commas. The original figure and description suggest that this species is very different from typical *Succinea*. New material is required.

Figure	Genus	Species	Unguja	Jozani (2000 survey)	Tropical W. Afr.	E. Afr. highlands	E. Afr. arid areas	E. Afr. coast	S.E. Afr. Coast (Moz., KZ-Natal)	S.E. Afr. inland (Malaw., Zamb.)	Pemba	Mafia	Comoros	Aldabra	Seychelles	Madagascar	Tropical Asia	First Unguja record by	Certainty of Unguja record	Certainty of identification
-	*Ptychotrema*	*affectatum*			*													Excl: Pilsbry, 1919	-	+++
-	*Zootecus*	*contiguus*																Excl: Pilsbry, 1906	-	++
5	*Tropidophora*	*creplini*	?										*					Excl: this study	+	+++
-	*Achatina*	*immaculata*							*									Excl: Bequaert, 1950	-	++
-	*Trochonanina*	*ibuensis*			*													Excl: this study	-	+
-	*Zootecus*	*insularis*					*										*	Excl: this study	-	++
-	*Achatina*	*lactea*					*											Excl: Bequaert, 1950	-	++
-	*"Euonyma"*	*magilensis*				*		*										Excl: Verdcourt, 1968	-	+++
-	*Rochebrunia*	*obtusa*					*											Excl: this study	-	++
-	*Trochonanina*	*percarinata*			*													Excl: this study	-	+
-	*Trochonanina*	*plicatula*	i?				*											Excl: Verdcourt, 1983	+	+++
-	*Zingis*	*radiolata*																Excl: this study	-	+++
-	*Rhachistia*	*rhodotaenia*					*	*										Excl: von Martens, 1897	-	+++
59	*Gulella*	*wahlbergi*	i?						*									Excl: this study	+	++
-	*Achatina*	*craveni*							*	*								Excl: this study	+	++
8	*Trochonanina*	*crenulata*	?															Excl: this study	+	+++
-	*"Buliminus"*	*costatus*	?															Excl: Verdcourt, 1981	+++	-
-	*"Helix"*	*dubia*	?															Excl: Verdcourt, 1981	+++	-
-	*Pseudoglessula*	*kirkii*	?			*		*	*									Excl: this study	+++	+
-	*Cecilioides*	*pergracilis*	?						*									Excl: Herbert & Kilburn, 2004	+	+
-	*Gulella*	*bernardi*	?															Excl: Verdcourt, 1981	+++	+
-	*"Pupa"*	*turricula*	?															Excl: Verdcourt, 1981	+++	-
-	*"Zonites"*	*ventrosa*	?															Excl: Verdcourt, 1981	+++	-
-	*Achatina*	*zanzibarica*						*										Excl: Mead, 1995	+	+

Table 2 Excluded species (symbols as in Table 1). For more detail see text of checklist.

EXCLUDED SPECIES (SEE TABLE 2)

EXCLUDED ON GROUNDS OF UNCERTAIN LOCALITY

Ptychotrema affectatum (Fulton, 1902)

Distribution Angola (Pilsbry, 1919).

Remarks Pilsbry (1919) suggested the type locality "Zanzibar" was erroneous (the larger species of *Ptychotrema* being an inland, highland or western group) and that the true distribution is in Angola. Specimens bearing the locality "Zanzibar", likely to be from Fulton's dealership, are to be found in IRSNB, MRAC, NMW, and NMS and probably elsewhere.

Zootecus contiguus (Reeve, 1849)

Distribution Abd-El Kuri, Sokotra archipelago (type locality; Pilsbry, 1906).

Remarks Pilsbry (1906) noted that this was erroneously recorded from Zanzibar (no reference was given).

Tropidophora creplini (Dunker, 1848)

Fig. 5

Distribution "*Ex insula Zanzibar Africae orientalis reportavit cl. Rodatz*." (Dunker, 1848; type locality); "Zanzibar" (Verdcourt, 1983); Comoros (Fischer-Piette & Vukadinovic, 1974).

Remarks I have seen numerous specimens of this large and distinctive species labelled "Zanzibar" at MNHN, NMS and NMW (NMW.Z.1981.118.00244 and others). Gibbons (MS) recorded it from "Zanzibar" [Unguja], quoting "Woodward" but gave no other data as he did for other species. It is thus reasonable to assume that he did not find it himself, although the species is not mentioned in Woodward's *Manual of the Mollusca* (1851-1856), the Woodward work which Gibbons (MS) mentions elsewhere. Fischer-Piette & Vukadinovic (1974) record it in quantity from the Comoros (specimens labelled "Comoros" or islands thereof) but are surprised that the various earlier Comoros works of Morelet did not record it. Possibly Morelet was familiar with the type locality and doubted that a Zanzibar species would occur on the Comoros. In this confusing situation I do the opposite and doubt that this confirmed Comoros species occurs in E. Africa where it has no obvious close relatives. NMW and NMS also contain specimens from "Madagascar" but Fischer-Piette & Vukadinovic (1974) do not mention this locality. I suspect that the source of such shells is the Comoros and that they have been restrospectively labelled with erroneous localities. Only new specimens that are definitely from Unguja will resolve this problem.

Achatina (Lissachatina) immaculata Lamarck, 1822

A. panthera Férussac, 1832 (nomen nudum) not von Martens, 1859 syn. by Verdcourt, 1983

Distribution "Insel Zanzibar" [Unguja?] (von Martens, 1897, as *A. panthera* "Férussac"); perhaps Kahama, Tanzania, all other E. African records being erroneous (Verdcourt, 1983).

Remarks Bequaert (1950, p.100) believed this and specimens of "true *panthera*" labelled "Zanzibar" to be wrongly localised as Gibbons (1879) and F. X. Williams (as cited by Bequaert) did not find it on Unguja. Bequaert (1950, p.100) also believed *A. layardi* L. Pfeiffer, 1858 was potentially a synonym of *A. panthera/immaculata*. *A. layardi* was another species recorded from Zanzibar Island by von Martens (1897) – if *A. layardi* was a synonym of "true *panthera*" Bequaert would have discounted von Martens' record. Unfortunately, *A. layardi* was one of the few species of *Lissachatina* not dealt with by Bequaert in detail. Gibbons (MS) wrote that he had not seen it "this far up the coast". This and its current uncertain status is my justification for excluding *A. layardi* from the present checklist.

Trochonanina ibuensis (L. Pfeiffer, 1846)

Distribution Ibu (or Ibo) in the Niger Delta (von Martens, 1876; type locality); imported with sesame bags from "Zanguébar" [the E. African coast] (Bourguignat, 1889).

Remarks Von Martens (1876) said the type locality was not to be confused with Ibo on the Mozambique coast, which may have escaped Bourguignat (1889). Von Martens' figures of the shell suggest it is not very distinctive, and Bourguignat's "Zanguébar" material may well have been the widespread eastern *T. mozambicensis*. The source of Bourguignat's sesame cargo might also be questioned.

Zootecus insularis (Ehrenberg, 1831)

Distribution Cape Verde Is. to the Middle East and S. Asia; Ethiopia (Pilsbry, 1905); N. Kenya (Verdcourt, 1983).

Remarks This species of semi-arid areas was recorded from "Zanzibar" by Connolly (1928). It has not been widely found in E. Africa and I suspect the "Zanzibar" of this publication refers to the mainland as mentioned above.

Achatina (Lissachatina) lactea Reeve, 1842
Distribution "Zanzibar" (Connolly, 1928; type locality); Kenya, Somaliland and other inland areas formerly circumscribed by the name "Zanguebar" (Bequaert, 1950).
Remarks Bequaert (1950, p.98) believed that type locality "Zanzibar" could not refer to Unguja as the species was reliably known (at least by c.1950) only from northern inland areas. This presumably includes the record of Connolly (1928).

"Euonyma" magilensis (Craven, 1880)
Distribution Between the E. Usambaras & Mt. Mlinga, Magila (type locality; Verdcourt, 1968); E. Usambaras and adjacent foothills and coast, N. E. Tanzania (Verdcourt, 1968).
Remarks Verdcourt (1968) notes that specimens in ZMB from "Zanzibar coast, in woods under stones" are probably from the mainland and not the island. According to Bequaert (1950) a type locality has yet to be designated.

Rochebrunia obtusa Bourguignat, 1881
Distribution "Zanzibar" [probably not Unguja] (Bourguignat, 1881; type locality); Cape Gardafui, Somalia and as fossils from another Somali locality (Bourguignat, 1889).
Remarks from Bourguignat's (1881) figure this may be a *Revoilia* (revised by Crowley & Pain, 1978, though they do not mention this species). *Revoilia* is present in semi-arid parts of northern Kenya (Crowley & Pain, 1978) but Verdcourt (1983) does not include this species in his list of E. African molluscs. I follow Verdcourt (1983) in assuming the term "Zanzibar" did not refer to Unguja.

Trochonanina percarinata von Martens, 1876
Distribution Bonjongo, Cameroon (von Martens, 1876; type locality); imported with sesame bags from "Zanguébar" [the E. African coast] (Bourguignat, 1889).
Remarks Like *T. ibuensis* above, this species identified by Bourguignat may be synonymous with *T. mozambicensis.*

Trochonanina plicatula (von Martens, 1869)
Distribution "Sesam, Insel Zanzibar" (von Martens, 1869; type locality); N. Frontier Province; Masai District; and Machakos District (all Kenya); Steppe around Kilimanjaro; Serengeti (both Tanzania); "Zanzibar (introduced)" [Unguja] (Verdcourt, 1983); not listed in Verdcourt (2000).
Remarks Verdcourt (1983) was prepared to consider *T. plicatula* a bushland or savanna species that was introduced to Unguja. With no data on whether it still survives there I exclude it from the present checklist.

Zingis radiolata von Martens, 1878
Distribution Teita Hills, Kenya (von Martens, 1878; type locality); "Zanzibar" [Unguja?] (Bourguignat, 1889).
Remarks Bourguignat (1889) fleetingly referred to this as coming from Zanzibar in his statement on the systematic position of *Zingis* but I am sure this must have been an error. Bourguignat was discussing its genital anatomy, but this seems to have been based on von Martens' earlier figures and not on fresh material. Both Verdcourt (1983) and Tattersfield *et al*. (1998) give Teita Hills as the only locality.

Rhachistia rhodotaenia (von Martens, 1878)
Distribution "Gebiet des Tana-Flusses" [near Tana River, Kenya] (von Martens, 1878; type locality); "Zanguébar et Zanzibar" [both Unguja and the nearby coast] (Bourguignat, 1889); eastern Kenyan localities (Verdcourt, 1983).
Remarks this is a distinctive species, associated with bushland (Verdcourt, 2000). Neither von Martens (1897) nor Verdcourt (1983) record it from the islands, so Bourguignat's "Zanzibar" record may have been incorrect.

Gulella wahlbergi (Krauss, 1848)
Fig. 59
Distribution "Natal" (type locality given in Connolly, 1939); Delagoa Bay, Mozambique (Connolly, 1925b); "endemic to central KwaZulu-Natal" (Herbert & Kilburn, 2004); not noted in Jozani Forest (2000 survey).
Remarks Several correctly identified specimens bearing this name and the locality "Zanzibar" have been located in the NMW and NMS collections. However, Herbert & Kilburn (2004) conclude *G. wahlbergi* was endemic to coastal forest around Durban and may be extinct. The possi-

bilities surrounding the identity and distribution of this species include: i) it naturally occurs in suitable habitat from KwaZulu-Natal to East Africa; ii) it has been introduced in some parts of this range (including perhaps the Durban area); iii) it is synonymous with one or more of the species grouped with it by Herbert & Kilburn, 2004; iv) it has been confused with them by earlier authors and collectors; v) some combination of the above. Introduction may be likely given the age of Zanzibar [the town] and Durban as ports, the fact that all of the records are old – perhaps indicating short-lived populations – and the record of introduction to Hawaii as an *Achatina* control agent (Cowie, 1998a). For the time being, however it is safest to exclude it from the present list and to assume the "Zanzibar" specimens are not from Unguja or at least that the species is unlikely to be found there.

EXCLUDED ON GROUNDS OF UNCERTAIN IDENTITY

Achatina (Lissachatina) craveni E. A. Smith, 1881

nom. subst. for *A. kirkii* Smith, 1880, preocc.

Distribution Between Zanzibar and Lake Tanganyika (type locality; Smith, 1881); "Insel Zanzibar" [Unguja] and inland Tanzania (von Martens, 1897); Malawi and KwaZulu-Natal (van Bruggen, 1969).

Remarks Not listed by Verdcourt (1983, 2000) for E. Africa or by Herbert & Kilburn (2004) for KwaZulu-Natal. Bequaert (1950) gives synonyms (none recorded from the coastal islands) but does not review its distribution. Following Verdcourt (1983, 2000) I exclude it from the present list.

"Trochonanina" (Crenatinanina) crenulata Germain, 1905

Fig. 8

Distribution "environs de Zanzibar" (Germain, 1905; type locality); "Zanzibar" [Unguja?] (Germain, 1920-1923).

Remarks I exclude this species based on confusion about its identity and locality, but this is only tentative. The subgenus *Crenatinanina* Germain is currently monotypic. Germain's figures (Fig. 8) show a unique combination of widely spaced crenulations and an occluded umbilicus, though otherwise the shell resembles the widespread coastal Tanzanian species *Sitala leroyi* (Bourguignat) and *S. mazumbaiensis* Verdcourt from the Usambara Mts. (Verdcourt, 1977). However, the type could not be found at MNHN despite searching (November 2005, and earlier by other workers) and may be lost. The type locality, too, is confusing because Germain (1905) described it from material collected by Raffray in 1891 from the "environs de Zanzibar". The rest of the 1905 paper dealt with species from Lake Chad, and Germain did not mention *T. crenulata* in his (1918) paper which apparently dealt with all the other Unguja molluscs collected by Raffray in 1891. Germain then (1920-1923) redescribed and figured *crenulata* and described the new subgenus. However, he gave only the locality "Zanzibar", and then only in the caption to the figures and not in the text. (Incidentally, the 1920-1923 figures, said to be "grandeur naturelle" at 46mm maximum diameter, are much larger than the type, said to 15.5mm maximum diameter).

"Buliminus" costatus Taylor, 1877 (attributed to "Gibbons MS" by Taylor, 1877b)

Distribution "Zanzibar" [Unguja] (Taylor, 1877b; type locality).

Remarks Verdcourt (1983) placed this taxon in Enidae in his checklist under "Genus uncertain". The whereabouts of the types are unknown (Verdcourt, 1981).

"Helix" dubia Taylor, 1880

Distribution "a sandy place at Zanzibar" [Unguja] (Taylor, 1880; type locality).

Remarks Verdcourt (1981) notes that native helicids are unlikely in E. African lowlands and this may be a juvenile *Trochonanina* (Urocyclidae). It could equally apply to a *Thapsia* (Urocyclidae) as these now common snails were not mentioned by Gibbons or Taylor in their Unguja studies. The whereabouts of the types are unknown (Verdcourt, 1981).

Pseudoglessula kirkii (Dohrn, 1865) not Craven, 1880

Bulimus bridouxi Bourguignat, 1889 syn. by Verdcourt, 1967

Bulimus (Cerastus) arctistria Kobelt, 1902 syn. by Verdcourt, 1967

Distribution Mainland Mozambique near Cabaçeira (Dohrn, 1865; type locality of

kirkii); "entre Kondoa et Mpouapoua, dans l'Ousaghara" [Usagara, Tanzania] (Bourguignat, 1889; type locality of *B. bridouxi*) Kissemo and Magila, Tanzania (Verdcourt, 1967); Masai Steppe, Mandaleo Mts. and Usamdawi, Tanzania (Verdcourt, 1983).
Remarks Germain (1918) commented on a "grande forme" from Zanzibar that was intermediate between *P. ptychaxis* (E. A. Smith, 1880) and *P. kirkii*. Germain stated that *P. ptychaxis* had been wrongly synonymised with *P. boivini* by von Martens (1897). This was reiterated by Verdcourt (1967) who kept *P. ptychaxis* out of the *boivini-subolivacea* complex and restricted its distribution to the far West of Tanzania, effectively discounting the Zanzibar record. He does not give the Zanzibar record under *P. kirkii* either, but gives that species a range in coastal East Africa. I therefore adopt the name *kirkii* but exclude it from the checklist for Unguja. All these species are somewhat similar in appearance (e.g. see Connolly, 1925b).

Cecilioides pergracilis Connolly, 1939
Distribution Mfongosi, KwaZulu-Natal (type locality), Isipingo, KwaZulu-Natal, and "in Zanzibar" [probably Unguja] (Connolly, 1939); River Turkwell Drift, Kenya and "Zanzibar" [Unguja] (Verdcourt, 1983).
Remarks Despite Connolly's Zanzibar record and Verdcourt's repetition of it, Herbert & Kilburn (2004) consider this a southern species and that the specimen in BMNH is too badly damaged for positive identification.

Gulella bernardi van Bruggen & van Goethem, 1997
Gulella sexdentata (Taylor, 1880) (as *Pupa (Ennea) sex-dentata*) not *sexdentata* von Martens, 1869 syn. by van Bruggen & van Goethem, 1997
Distribution "Zanzibar" [Unguja] (Taylor, 1880; type locality); not noted in Jozani Forest (2000 survey).
Remarks This species was allegedly figured ("Pl. i, f. 5") but the plate was not published, and the whereabouts of the type (a single empty shell according to Taylor, 1880) are unknown (Verdcourt, 1981). Van Bruggen & van Goethem (1997) nonetheless introduced the name *bernardi* as a replacement for the homonym *sexdentata* Taylor. Verdcourt (1962) noted that this species is possibly the same as that later described as *G. gwendolinae* (Preston, 1910) (type locality: Shimba Hills, Kenya). This is very probable judging from the description and considering that *gwendolinae* is distributed from S.E. of Lake Chad, W. of Lake Rudolph in Kenya to the E. African coast and the Aldabra Islands (van Bruggen, 1975a; Gerlach & Griffiths, 2002). *G. gwendolinae* has not yet been recorded from Unguja.. *G. dentiens* (Morelet, 1883) of the Comoros is possibly the same species as *G. gwendolinae* (van Bruggen, 1975b).

"Pupa" turricula Taylor, 1880
Distribution "Zanzibar" [Unguja] (Taylor, 1880; type locality).
Remarks This could represent a streptaxid, vertiginid or pupillid other than those listed by Taylor. From the description and the notes of Verdcourt (1962) I think it could be a brown *Gulella radius* (see above). The whereabouts of the types are unknown (Verdcourt, 1981).

"Zonites" ventrosa Taylor, 1877 (attributed to "Gibbons MS" by Taylor, 1877a)
Distribution "Zanzibar" [Unguja] (Taylor, 1877a; type locality).
Remarks Verdcourt (1981) commented that this had sometimes been referred to *Tayloria* (Streptaxidae) (e.g. by Bourguignat, 1889) but was more likely to be a juvenile *Thapsia* (Urocyclidae) because it was brown. I think Taylor's figure and description, especially of the sculpture at the suture, which was said to be deep, is more suggestive of a streptaxid. Rather than a small *Tayloria* it could be a young *Gonaxis*; the periostraca of both are sometimes brown. The whereabouts of the types are unknown (Verdcourt, 1981).

Achatina (Lissachatina) zanzibarica Bourguignat, 1879
A. lhotelleri Bourguignat, 1879 syn. by Bequaert, 1950
Distribution "Nasimoya, Zanzibar" [Mnazi Mmojo, Unjuga] (Bourguignat, 1879; type locality of both species); coastal areas from S. E. Kenya S. to S. Tanzania (Mead, 1995).
Remarks The placement, status and distribution of this species are questionable. Bequaert (1950) suggested the type locality ought to be confirmed (by collection?) as all recent records were from the coastal mainland, where it is widespread. Mead (1995) maintains there is no verifiable record of

Rank N-S	Coastal Forests	No. plots	S	alpha	H'	Rank S	Rank H'
1	Amboni	4	29	14.25	2.69	1	1
3	**Jozani all plots**	**2**	**29**	**22**	**2.26**	**1**	**5**
3	**Jozani plot I only**	**1**	**28**	**-**	**2.57**	**2**	**2**
5	Pugu	3	22	16	2.57	3	2
6	Pindiro	4	22	11.25	2.13	3	7
6	Ngarama	3	21	12.33	2.47	4	3
4	Pande	2	19	12	2.34	5	4
3	**Jozani plot II only**	**1**	**16**	**-**	**1.95**	**6**	**8**
7	Nanganga	1	11	11	2.17	7	6
2	Miono	1	6	6	1.7	8	9
8	Masasi	1	6	6	1.18	8	10
	Mean		19.00	12.31	2.18		
	Median		21	12	2.26		
	Eastern Arc Forests (n = 13)						
	Mean		24.31	14.61	2.44		
	Median		16	15	2.49		

Table 3 Diversity statistics for a number of Tanzanian forests including Jozani. S, number of species; alpha, mean number of species per plot; H' , Shannon diversity index (log e). Data for each Jozani plot shown separately and combined in bold type. Data for forests other than Jozani from Tattersfield (1998), Tattersfield et al. (1998) and NMW unpublished (Pande). Coastal forests could be ranked by latitude (Rank N-S) but are ranked here by S and H'.

the species occurring on Unguja. Matters are complicated by Mead's suggestion that *A. zanzibarica* is the most variable of all East African achatinids, is "anatomically and conchologically transitional between *A. allisa* and *A. fulica*", and may include more than one species.

RESULTS OF JOZANI FOREST SURVEY

Plots I and II in the Jozani survey yielded 613 specimens belonging to 29 species in a total of 12 person hours with 24 litres of litter sieved. The number of specimens of each species is given in Table 1. The 2 "miscellaneous" replicates returned another 106 specimens but no further species. Along with 2 specimens (shell fragments) that could not be identified to family level these specimens are excluded from the analysis. Relative to other coastal forests as surveyed by Tattersfield (1998) and NMW (unpublished) using similar methods, total species richness (S) and the mean number of species per plot (alpha) was high, ranking with or above the especially rich Amboni Caves Forest near Tanga (Table 3). However, the overall Shannon diversity index (H') was only the median value for coastal forests, reflecting lowered evenness. The lowered evenness is partly a result of the dominance of a few abundant species. For both plots combined, the 4 most abundant species (*P. subolivacea, T. curvatula, O. delicatum* and *T. zanguebarica*) account for 388 individuals, more than 63% of the total. Only 3 species are needed to account for half the total individuals, giving a "common species index" (Emberton *et al*., 1997) of 0.97, higher than any other recorded by these authors. Plot II had both a lower number of species (16 as opposed to 22) and a still lower evenness than plot I. However, Plot I itself yielded nearly as many species and with nearly the same Shannon index as Amboni (as surveyed by Tattersfield, 1998) and more species and a higher number of species and Shannon index than the mean or median values for a number of Eastern Arc montane forests (as surveyed by Tattersfield *et al.* 1998). Although Emberton *et al*. (1997) recorded higher species numbers from some of the same sites in Tattersfield (1998), the Jozani fauna can thus be said to rank as relatively rich among the

coastal forests.

For plots I and II combined, the pattern of richness and abundance in different families was comparable to that recorded from other E. African coastal forests by Emberton *et al*. (1997). Streptaxid richness (9 species, 31% of the total) exceeded that of all other families, as was the case in most of Emberton *et al.*'s sites. However, streptaxids were only the third most abundant family at Jozani (89 individuals, 15% of the total) after subulinids and urocyclids, with pomatiasids fourth most abundant. In all of Emberton *et al*.'s sites bar one, streptaxids were more abundant than subulinids. These values are influenced by the four most abundant species just listed. The unanalysed extra specimens from the "miscellaneous" collections reinforced this pattern, although there may have been a bias against smaller or harder-to-find taxa in these collections.

DISCUSSION OF THE FAUNA

JOZANI AND OTHER COASTAL FORESTS

The 2000 survey, despite being relatively small, showed Jozani to be one of the most diverse coastal forests yet investigated. This may be a consequence of the long-term climatic stability caused by the maritime location, (including relatively high annual rainfall) allowing many species to persist longer than in other coastal forest fragments. This could be critical given the relatively small size of Jozani Forest itself. However, this is only one possible abiotic factor among many that have not been fully investigated. The differences between plots I and II suggest that other factors, acting on a smaller scale are likely to be involved. Tattersfield (1998) found that the faunas of coastal forests differed strongly even when environmental conditions were similar. The observed dominance of a few common species may reflect seasonal changes in abundance or perhaps some level of disturbance. Tattersfield *et al.*, (2001), Lange (2003) and C. Ngereza (unpubl.) have found that E. African forests disturbed by plantation species have a less even fauna than indigenous forest. The makeup of the fauna is fairly typical but includes several species not yet recorded from other coastal forests (e.g. the ferussaciids, *Gulella tracheia, G. streptosteleopis, G. peakei continentalis, Streptostele acicula* and so on). This is consistent with the pattern of high turnover between coastal forests, conspicuous among the streptaxids, reported by Tattersfield (1998) who found that faunal differences between coastal forests were often comparable to those between the much larger vegetational zones. Tattersfield (1998) suggested that some of the turnover was a consequence of endemic species with very small ranges. Jozani was not found to host any other strictly endemic species. The separation of the forest from the mainland by sea is probably more recent than the separation of many other coastal forest fragments from one another (Clarke & Burgess, 2000). Jozani is thus a typical, albeit diverse, coastal forest that does not host an especially high number of strict endemics. Tattersfield (1998) also considered that species may have wider ranges and be restricted to more than one forest fragment. The high turnover could be explained by non-overlapping distributions of this type (*G. tracheia*, not yet found in other coastal forests but found inland, may represent an example). As Tattersfield (1998) suggests, small coastal forests should continue to be afforded conservation status to protect species whether restricted to one or a few forest fragments.

BIOGEOGRAPHY OF THE UNGUJA FAUNA

The revised checklist and Jozani survey allow the species of Unguja and the other coastal islands to be classified into groups according to their known distribution. At present this classification is necessarily simplistic but allows a broad analysis of areas of endemism and speciation over the past and present determinants of distributions. Further recording can test the classification. Although Verdcourt (2000) shows that endemism in forest-specialist molluscs is more pronounced than in non-forest species, forest and non-forest species (as defined by Verdcourt, 2000) are split between the groups below. A better understanding of the complex biogeography of the E. African land mollusc fauna may require more data on the ecological requirements of species beyond the simple forest/non-forest split.

1. A group of 7 species (11%) are currently not known outside of the Tanzanian coastal islands: *Maizania zanzibarica*; *Edouardia conulina*; *Achatina eleanorae*; *Gulella minutissima*; *Streptostele bawriense*; *Elisolimax roebucki*; *Pembatoxon insulare*. The specific rank of *M. zanzibarica* and *E. roebucki*

has been questioned in the literature and I have done the same for *S. bawriense* (see checklist). However, *E. conulina* and *P. insulare* are both relatively distinctive (*Pembatoxon* being monotypic). They are unusual in being recorded from both Unguja and Pemba but not elsewhere, a situation that may deserve investigation. Mead (1995) considered *A. eleanorae* a strict island endemic to Mafia and associated islets. *G. minutissima* is currently unknown from beyond Unguja and may be a strict endemic. It seems that these latter three species have their closest relatives in E. Africa and, for the time being, can be considered an extreme eastern endemic element of the fauna. Their ranges may be restricted by the climatic regime that has prevailed on the islands since before the Pleistocene (Prell *et al.*, 1980; Clarke, 2000), and by the channels between the islands and the mainland.

2. 14 species (23%) have coastal E. African distributions: *Eussoia aurifera; Tropidophora zanguebarica; Laevicaulis zanzibaricus; Edouardia tumida; Rhachidina braunsi; R. melanacme; R. mozambicensis; Rhachistia hildebranti; R. picturata; Cecilioides callipeplum; Subulina intermedia; Opeas lamoense; Gonaxis quadrilateralis; Sitala jenynsi*. Many of these probably extend into Mozambique in the Zanzibar-Inhambane mosaic vegetation and their distributions may be governed by the same factors. Although Verdcourt (2000) suggests several of these are forest specialists, some may be tolerant of degraded forest and bushland. They include relatively few streptaxids. The same kind of distribution is seen in many other organisms of the coastal forests and the surrounding Zanzibar-Inhambane vegetation (see appendices in Burgess & Clarke, 2000).

3. 24 species (39%) have distributions in both coastal and inland E. Africa: *Gastrocopta klunzingeri; Pseudopeas igembiense; Opeas delicatum; Pseudoglessula subolivacea; Homorus usagarica; Achatina allisa?; A. reticulata; Edentulina obesa; E. ovoidea; Gonaxis denticulatus; G. gibbonsi?; Gulella baccata; G. jod; G. sexdentata; G. peakei continentalis; G. radius; G. tracheia; G. streptostelopsis; G. vicina; Trachycystis lamellosa; Thapsia curvatula; Trochonanina bloyeti; T. mozambicensis*; *Trichotoxon heynemanni.* They may extend into highland forests, *G. tracheia* being an example of a species otherwise known only from the Eastern Arc mountain forests, albeit at low elevations. However, this group does not include any of the characteristic E. African montane taxa (see Tattersfield *et al.*, 1998). Most of the species are forest litter specialists, but others are generalists and can be found in woodland or disturbed habitat (e.g. *P. subolivacea, T. mozambicensis*). Some are widely distributed from Kenya south to KwaZulu-Natal (e.g., *P. subolivacea, T. mozambicensis, G. peakei continentalis*) and some appear to extend west beyond the Albertine Rift (e.g. *G. sexdentata, G. vicina, T. heynemanni*). These distributions may be relicts of wider forest cover in pre-Miocene times. Several of the small streptaxids also show an affinity with Indian Ocean island taxa (see below).

4. 16 species (26%) have very wide distributions*: Laevicaulis alte; Pupoides coenopictus; Nesopupa minutalis; N. bisulcata; Rachis punctata; Cecilioides kalangwaensis; Subulina octona; Lamellaxis gracilis; Achatina fulica; Streptostele acicula; Deroceras reticulatum; Afroguppya rumrutiensis; Afropunctum seminium; Kaliella barrakporensis; Quickia concisa; "Succinea" pseudomalonyx. L. alte, S. octona*, *L. gracilis*, and *A. fulica* are virtually circumtropical and it is well-documented that these, and *D. reticulatum*, have been spread by man; they are often synanthropic but with human activity encroaching on natural areas this may sometimes be difficult to ascertain. *R. punctata* appears to be a desiccation-tolerant species that could live on virtually any Indian Ocean coast and its habit of climbing trunks or posts may have helped it spread either naturally with driftwood or with cargo. Records based on the simple shells of ferussaciids and succineids are problematic and their distributions must be interpreted with caution, but those from Unguja are referable to tropical West African species. Their subterranean and sometimes hygrophilic habits, respectively, may mean they are less capable of passive natural dispersal than some species. The remaining species, *N. minutalis, N. bisulcata, S. acicula, A. rumrutiensis, A. seminium,* and *K. barrakporensis* have wide African, coastal or Indian Ocean island distributions in habitats ranging from undisturbed to synanthropic. Their small size and desiccation tolerance may give them exceptional powers of passive disper-

sal with or without human help.

Of the species in the checklist, 11 (a separate 18% of the total) show Indian Ocean island affinities. These are: *N. minutalis; N. bisulcata; E. ovoidea; G. jod; G. peakei continentalis; G. radius; G. streptostelopsis; S. acicula; K. barrakporensis; A. rumrutiensis*, *Q. concisa*. In some cases the same species is distributed across more than one island group; in other cases, the species is restricted to one island group or the mainland, being represented on others by what is apparently a close relative (see Table 1). Occurrence of close relatives on other islands suggests an ancient, and thus probably natural distribution because of the time taken for speciation to occur. Quaternary fossils of widespread African species, as recorded by van Bruggen (1975b, 1972-1975) (*G. peakei* and *G. gwendolinae* on Aldabra) also indicate a natural distribution. A natural distribution including the volcanic oceanic islands (the Comoros, Aldabra and the Mascarenes) may seem especially remarkable because their faunas have traditionally been thought to have been assembled by dispersal. This is despite the great distances involved and the relatively young ages of the islands compared to the mainland or other landmasses (Madagascar and the Seychelles). Nevertheless, dispersal of low vagility terrestrial taxa across large oceanic distances is increasingly invoked by biogeographers (de Queiroz, 2005), including among E. Africa and islands of the Western Indian Ocean (Raxworthy *et al*., 2002; Vences *et al*., 2003). By recording several Indian Ocean island species from E. Africa (Unguja) for the first time, and noting some close similarities between others, the present paper supports the perspective of wide Indian Ocean distributions for a number of taxa. However, there remain cases where distributions are likely to have been much altered by anthropogenic introduction. For example, although both *G. peakei* and *S. acicula* show similar distributions, only *G. peakei* is currently known to have occurred on Aldabra (and presumably the African mainland) in prehistoric times. More faunistic and systematic work is required before such patterns can be shown to be more general.

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FIGURE CAPTIONS

Plate 1 (figs. 2-8). * denotes excluded species. **2.** *Maizania zanzibarica*, holotype, MCZ.72326 (w25mm). **3.** *Tropidophora zanguebarica*, Jozani Forest, NMW.Z.2004.014.00009 (w12mm). **4.** *Thapsia curvatula*, Jozani Forest, NMW.Z.2004.014.00010 (w12.2mm). **5.** **Tropidophora creplini*, "Zanzibar", NMW.Z.1981.018.00244 (h19.6mm). **6.** *Trochonanina mozambicensis*, syntype, BMNH (w11.5mm). **7.** *Trochonanina bloyeti*, syntype, MNHN (w14.8mm). **8.** **Trochonanina crenulata*, syntype, after Germain, 1920 (w11.5mm).

Plate 2 (figs. 9-17). **9.** *Nesopupa minutalis*, Jozani Forest, NMW.Z.2004.014.00011 (h1.3mm). **10.** *Nesopupa minutalis*, Mbudya Island, NMT (h1.35mm). **11.** *Nesopupa peilei*, Mauritius, ex auct., NMW.1955.158.24238 (h1.4mm). **12.** *Gastrocopta klunzingeri*, Jozani Forest, NMW.Z.2004.014.00012 (h1.5mm). **13.** *Nesopupa bisulcata*, Mbudya Island, NMT (h12mm). **14.** *Afroguppya rumrutiensis*, Jozani Forest, NMW.Z.2004.014.00013 (w1.2mm). **15.** *Trachycystis lamellosa*, Jozani Forest, NMW.Z.2004.014.00014 (w1.8mm). **16.** *Cecilioides kalawangaensis*, Jozani Forest, NMW.Z.2004.014.00015 (h2.1mm). **17.** *Pseudopeas igembiense*, Jozani Forest, NMW.Z.2004.014.00016 (h2.5mm).

Plate 3 (figs. 18-33).18. *Eussoia aurifera*, holotype, MRAC.26207 (h3.9mm). **19.** *Pupoides coenopictus*, syntype of *Leucocheilodes chanlerensis*, NMW.1955.158.01647 (h4.0mm). **20.** *Quickia concisa*, Shimba Hills, NMW.Z.1955.158.24241 (h5.9mm). **21.** *Caecilioides callipeplum*, Jozani Forest, NMW.Z.2004.014.00017 (h4.1mm). **22.** *Opeas lamoense*, syntype, NMW.1955.158.00730 (h9.3mm). **23-24.** *Opeas delicatum*, syntypes, BMNH.1910.5.20-21. (h6.5mm, h8.5mm). **25.** *Subulina intermedia*, "Zanzibar", NMW.1955.158.24242 (h8.6mm). **26.** *Lamellaxis gracilis*, syntype labelled "proposed lectotype", BMNH.1856.9.15.68 (h11.2mm). **27.** *Edouardia conulina*, Kilifi, NMW.Z.1992.023.01504 (h16.1mm). **28.** *Edouardia tumida*, syntype, BMNH.1910.9 (h12.6). **29.** *Rachis punctata*, Taru Desert, NMW.1955.158.24243 (h9mm). **30.** *Rhachidina mozambicensis*, Mozambique, NMW.1955.158.24244 (h17.9mm). **31.** *Rhachidina braunsi*, "Zanzibar", MNHN (h15.7mm) **32.** *Subulina octona*, Dar es Salaam, NMW.Z.2004.016.00001 (h19.2mm).**33.** *"Succinea" pseudomalonyx*, syntype, after Dupuis & Putzeys, 1901 (hXXmm).

Plate 4 (figs. 34-46). **34.** *Homorus usagarica*, syntype of *H. insularis*, MNHN (h33.8mm). **35.** *Homorus usagarica*, syntype, BMNH.1890.7.16.121 (h22.8mm). **36.** *Pseudoglessula subolivacea*, "Zanzibar" identified as *P. liederi*, MNHN (h26.3mm). **37.** *Gonaxis gibbonsi*, Chwaka Bay, Unguja, NMW.Z.1981.118.00245 (h7.8mm). **38.** *Gonaxis denticulatus*, near Tanga, Frontier Tanzania specimen (h7.4mm). **39.** *Gonaxis quadrilateralis*, Shimba Hills, NMW.1955.158.24245 (h23mm). **40.** *Pembatoxon insulare*, Jozani Forest, NMW.Z.2004.014.00018 (length 22.5mm). **41.** *Edentulina obesa*, syntype, BMNH.1910.9.5 (h21.2mm). **42.** *Achatina reticulata*, Chwaka Bay, Unguja, NMW.Z.1981.118.00246 (h169mm). **43.** *Achatina allisa* (as *A. iredalei*), Shimba Hills, NMW.Z.1955.158.24246 (h84mm). **44.** *Edentulina ovoidea*, Mkungwe, Uluguru Mts., NMW.Z.2003.001.00002 (h37.3mm). **45.** *Achatina fulica* (identified as form *hamillei*), "Zanzibar", NMW.Z.1955.158.24247 (h104mm). **46.** *Achatina eleanorae*, paratype, BMNH.1994.134 (h84mm).

Plate 5 (figs. 47-59). * denotes excluded species. **47.** *Streptostele acicula*, syntype, BMNH.1893.2.4.21 (h4.6mm). **48.** *Streptostele acicula*, Jozani Forest, NMW.Z.2004.014.00019 (h4.7mm). **49.** *Streptostele bawriense*, holotype, BMNH.1910.9.5.7 (h4.7mm). **50.** *Gulella jod*, Jozani Forest, NMW.Z.2004.014.00020 (h2.2mm). **51.** *Gulella minutissima*, syntype, after Thiele, 1911 (h3mm). **52.** *Gulella streptostelopsis*, Jozani Forest, NMW.Z.2004.014.00005 (h2.2mm).**53.** *Gulella tracheia*, holotype, NMW.Z.2004.014.00001 (h3.3mm).**54.** *Gulella peakei continentalis*, Jozani Forest, NMW.Z.2004.014.00021 (h1.8mm). **55.** *Gulella vicina*, Jozani Forest, NMW.Z.2004.014.00022 (h7.2mm). **56.** *Gulella radius*, Jozani Forest, NMW.Z.2004.014.00023 (h2.9mm). **57.** *Gulella baccata*, Jozani Forest, NMW.Z.2004.014.00024 (h5.8mm).**58.** *Gulella sexdentata*, Dar es Salaam, NMW.Z.2004.016.00007 (h8.1mm). **59.** **Gulella wahlbergi*, "Zanzibar", NMW.1955.158.24248 (h9.3mm).


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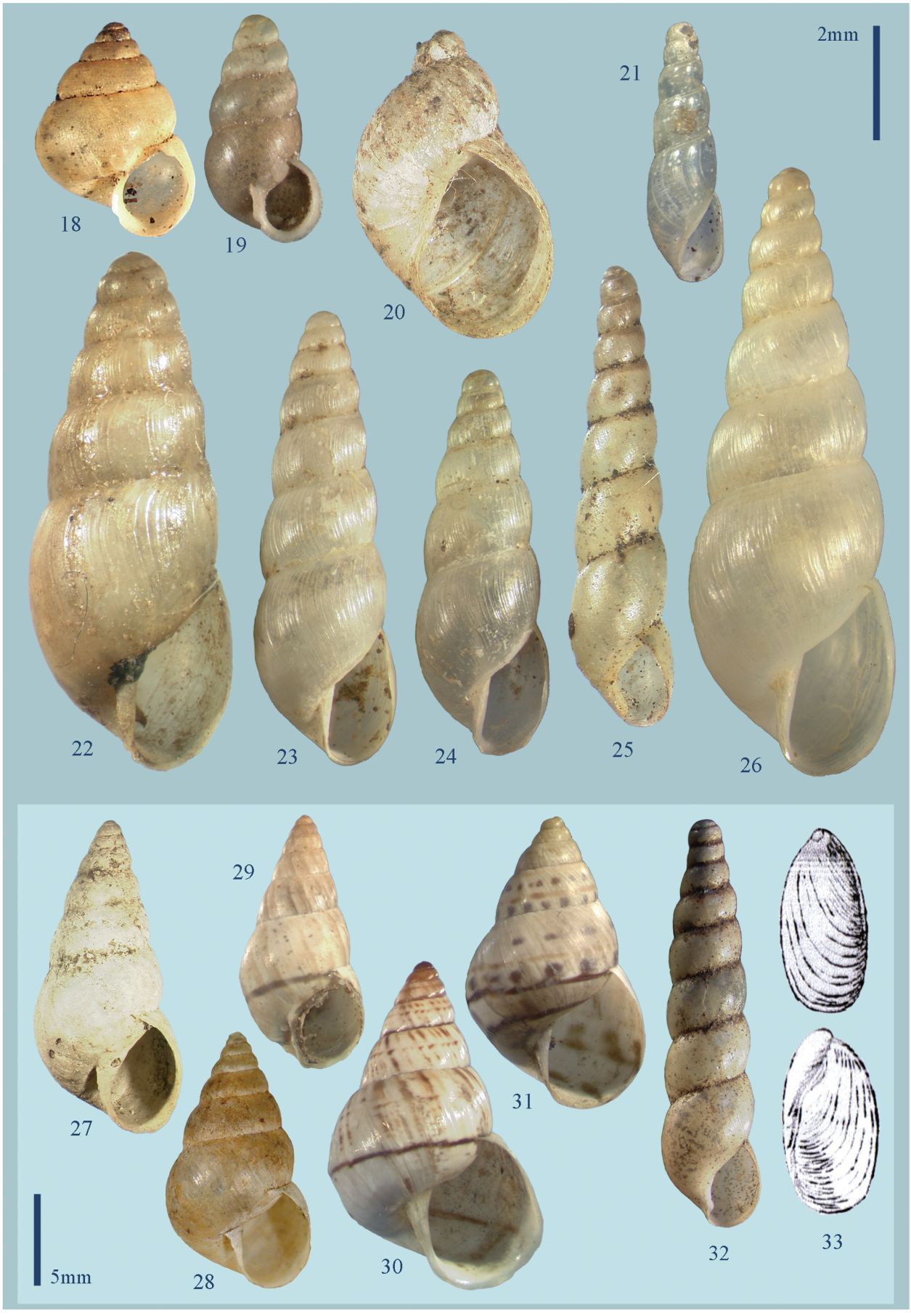
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