

**Environmental Management and Biodiversity Conservation of Forests,
Woodlands, and Wetlands of the Rufiji Delta and Floodplain**

**A Preliminary Biodiversity (Fauna) Assessment of the
Rufiji Floodplain and Delta**

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Rufiji Environment Management Project - REMP

Project Goal

To promote the long-term conservation through 'wise use' of the lower Rufiji forests, woodlands and wetlands, such that biodiversity is conserved, critical ecological functions are maintained, renewable natural resources are used sustainably and the livelihoods of the area's inhabitants are secured and enhanced.

Objectives

- To promote the integration of environmental conservation and sustainable development through environmental planning within the Rufiji Delta and Floodplain.
- To promote the sustainable use of natural resources and enhance the livelihoods of local communities by implementing sustainable pilot development activities based on wise use principles.
- To promote awareness of the values of forests, woodlands and wetlands and the importance of wise use at village, district, regional and central government levels, and to influence national policies on natural resource management.

Project Area

The project area is within Rufiji District in the ecosystems affected by the flooding of the river (floodplain and delta), downstream of the Selous Game Reserve and also including several upland forests of special importance.

Project Implementation

The project is run from the district Headquarters in Utete by the Rufiji District Administration through a district Environmental Management Team coordinated by the District Executive Director. The Project Manager is employed by the project and two Technical Advisers are employed by IUCN.

Project partners, particularly NEMC, the Coast Region, RUBADA, The Royal Netherlands Embassy and the Ministry of Natural Resources and Tourism, collaborate formally through their participation in the Project Steering Committee and also informally.

Project Outputs

At the end of the first five –year phase (1998-2003) of the project the expected outputs are:

An Environmental Management Plan: an integrated plan for the management of the ecosystems (forests, woodlands and wetlands) and natural resources of the project area that has been tested and revised so that it can be assured of success - especially through development hand-in-hand with the District council and the people of Rufiji.

Village (or community) Natural Resource Management Plans: These will be produced in pilot villages to facilitate village planning for natural resource management. The project will support the implementation of these plans by researching the legislation, providing training and some support for zoning, mapping and gazettement of reserves.

Established Wise Use Activities: These will consist of the successful sustainable development activities that are being tried and tested with pilot village and communities and are shown to be sustainable

Key forests will be conserved: Forests in Rufiji District that have shown high levels of plant biodiversity, endemism or other valuable biodiversity characteristics will be conserved by gazettement, forest management for conservation, and /or awareness-raising with their traditional owners.

Table of Contents

1	Introduction	1
1.1	Background to the Biodiversity and Conservation Values of Tanzania’s Coastal Forests.....	1
1.2	Animals of the coastal forests.....	1
1.3	Forest dependent species	1
1.4	Species diversity and endemism.....	1
1.5	Biodiversity information needs for conservation and management of the Tanzanian coastal forests	4
1.6	Terms of Reference	4
2	The Study Sites.....	5
2.1	Weme Site.....	6
2.2	Kichi Hills.....	6
3	Methods and Rationale.....	7
3.1	Small mammals.....	7
3.2	Amphibians and Reptiles	8
3.3	Other groups	8
4	Results.....	9
4.1	Small Mammals	9
4.2	Species list of mammals captured with comments on distribution and conservation status	9
4.3	Birds	12
4.4	Amphibians.....	13
4.5	Reptiles	18
4.6	Other Reptile Records	18
4.7	Species list of reptiles detected with comments on distribution and conservation status	19
4.8	Other species.....	21
5	Discussion	22
5.1	Weme and Kichi sites Compared.....	22
5.2	Weme and Kichi in comparison to nearby coastal forests	28
6	Threats to Biodiversity	29
6.1	Unsustainable use of the habitat with resultant change in forest quality and quantitative	29
6.2	Poaching	29
6.3	Live animal trade	29
7	Recommenations	30
7.1	The Need for Surveys and Monitoring	30
7.2	What types of surveys and monitoring are needed?	30
8	References.....	31
9	Appendicies	33
9.1	Appendix 1: Invertebrates	33
9.1.1	<i>Appendix 1a. Terrestrial Molluscs</i>	33
9.1.2	<i>Appendix 1b. Mangrove associated molluscs and crustaceans (crabs)</i>	35
9.1.3	<i>Appendix 1b: Crabs</i>	40
9.1.4	<i>Appendix 1c: Butterflies</i>	42
9.1.5	<i>Appendix 1d: Diplopoda</i>	43
9.2	Appendix 2: Vertebrates.....	44
9.2.1	<i>Appendix 2.1 Amphibians</i>	44
9.2.2	<i>Appendix 2.2 Reptiles</i>	46
9.2.3	<i>Appendix 2.3 Birds</i>	49
9.2.4	<i>Appendix 2.4 Mammals</i>	56
9.2.5	<i>Appendix 2.5 Fishes</i>	63

List of Figures

Figure 1: Distribution of Coastal Forests in Tanzania (after Burgess & Muir, 1994).....	3
Figure 2: Study site locations.....	5
Figure 3: Cumulative Number of Species and Cumulative Number of Individuals taken using Snap and Live Traps at Weme Site.....	24
Figure 4: Cumulative Number of Species and Cumulative Number of Individuals taken using Snap and Live Traps at Kichi Site.....	25
Figure 5: Cumulative Number of Species trapped by BPFLs, Weme Site, February 2000	26
Figure 6: Cumulative Number of Species trapped by BPFLs, Kichi Site, February 2000.....	27

List of Tables

Table 1: Coordinates for BPFL and associated snap and live trap lines, Weme Site.....	6
Table 2: Coordinates for BPFL and associated snap and live trap lines, Kichi Hills Site.....	6
Table 3: Small mammals captured and trap type used.....	9
Table 4: Trapping Success Rate, Small Mammals.....	9
Table 5: Other mammals recorded or reported from the study sites.....	12
Table 6: Number of individuals and per cent composition of amphibians captured in BPFLs.....	13
Table 7: Trapping Success Rate, Amphibians.....	13
Table 8: Number of individual amphibians captured by hand.....	14
Table 9: List of all amphibians detected at the two study sites and those detected by audio survey: + = heard.....	14
Table 10: Reptiles captured by BPFL trapping.....	18
Table 11: BPFL Trapping Success Rate, Reptiles.....	18
Table 12: Records of reptiles recorded by means other than by BPFL trapping.....	19
Table 13: Mammalian Species of Conservation Concern at Weme and Kichi Sites.....	22
Table 14: Mangrove-associated aquatic species of economic importance (Modified from Matthes & Kapetsky, 1988). Common names follow Abbott (1962).....	35
Table 15: Crabs of the Rufiji (mangrove) areas, based on Matthes & Kapetsky.....	40
Table 16: Butterflies Endemic to the Coastal Zone as defined by Kielland (1990).....	42
Table 17: Amphibians of the REMP area and surroundings.....	44
Table 18: Reptiles.....	46
Table 19: Birds of the Rufiji Area as recorded by Haldane (1946).....	49
Table 20: Bird assemblages and ornithological importance in Tanzanian coastal forests.....	55
Table 21: Larger Mammals of the Rufiji area.....	56
Table 22: Hyraxes, Lagomorphs and Rodents which may occur in the area, based largely on the general maps in Kingdon (1997) and unpublished SGR list.....	58
Table 23: Bats from coastal forests.....	59
Table 24: Elephant Shrews (Macroscelididae) and Shrews (Soricidae) from REMP and the surrounding area.....	60
Table 25: Primates of the REMP area and environs.....	61
Table 26: Fishes of the Rufiji River, based on Eccles (1992).....	63

1 Introduction

1.1 Background to the Biodiversity and Conservation Values of Tanzania's Coastal Forests

There has been considerable discussion over exactly how a coastal forest is defined (see Burgess & Muir, 1994). In an overview of eastern African coastal forest, Hawthorne (1993) takes "coast" to mean the areas lying over the sedimentary rocks of the coastal plain and related plateaux, to the east of the older basement rock complexes further inland. To avoid confusion with other vegetation types such as thicket, forest can be considered closed woody vegetation over 8m tall. This interpretation of coastal forest is followed herein. For details of the issues relating to the exact definition of coastal forests, see Hawthorne (1993), Burgess & Muir (1994) and Rodgers (1996).

Today, the coastal forests of Tanzania consist of scattered, highly fragmented patches of what was a much more wide-spread forest cover along the East African coastal strip (See Fig. 1). These existing patches of forest are so small that they do not appear on larger scale vegetation maps, in which the coast features simply as "coastal mosaic" or "moist savannah complex". Along the coast, there is considerable variability concerning elevation (some mountains and high hills arise from the coast), substrate (limestone, clay, etc) and rainfall. This variability is reflected in the complex nature of coastal forest vegetation.

1.2 Animals of the coastal forests

Aside from the numerous invertebrate animals that are found in coastal forests, many species of small and larger vertebrates make up the fauna of the coastal forests. Some of these visit the forests on a daily or seasonal basis for temporary shelter, food or use the forests as a seasonal breeding site. For example, some coastal forest birds are Intra-African migrants, such as the African Pitta *Pitta angolensis* and some populations of the Red-capped Robin Chat *Cossypha caffra*. Others such as the Barred Long-tailed Cuckoo *Cercococcyx montanus* migrate from forests at the higher elevations, to those of the coast in the non-breeding seasons. Other species such as some amphibians remain either in the soil or under bark and rotting logs during the dry season.

1.3 Forest dependent species

There are a number of vertebrate species that seem unable to survive outside of closed forest habitat and these are termed "forest dependent". Stuart (1983), Howell (1993) and Kingdon & Howell (1993) have discussed the basic distinctions between forest dependent species of vertebrates and those which are less or not at all dependent on forest. Examples of vertebrates of the coastal forests which appear to be forest dependent and therefore sensitive to forest alteration, fragmentation and destruction include *Rhynchocyon* elephant shrews, at least some Bushbabies (*Otolemur* and *Galagoides*) and *Colobus* monkeys (although largely absent from many coastal forests where they were once present). At least three species of toads found in the coastal forests can be regarded as forest dependent, *Stephopaedes howelli* and *S. usambarae* and *Mertensohryne micranotis*. A number of reptiles, including pigmy chameleons, *Rhampholeon brevicaudatus*, skinks such as *Scelotes litopoensis*, some *Lygodactylus* geckos and the lacertid lizards *Gastropholis prasina* and *G. bivittatus* lizards are forest dependent.

While there may be both practical and theoretical differences among biologists concerning the concept of forest dependence, research by Newmark (1991) on forest understory birds of the Usambara Mountains is of special interest. This study demonstrated that relatively rare and forest interior species are most adversely affected by forest fragmentation. It would appear that at least some species of vertebrates that are forest dependent are unable and/or unwilling to cross open gaps between forests. They also have physiological adaptations which tie them to the particular conditions found only in the interior of closed forests. If these patches of forest reach a critical threshold of minimal size, the populations of such species become locally extinct.

1.4 Species diversity and endemism

Very few if any coastal forests have been sufficiently studied to allow firm statements to be made regarding their species diversity. Birds are probably the best known of the vertebrate groups in coastal forest, but among Tanzanian coastal forests, only Pugu Forest Reserve has received long-term sampling

over a period of many years (Baker, in prep.). As noted above, forest species diversity is also complex because many species use the forest for varying periods of time but are not always resident there. Furthermore, because of the small size of the remaining forest patches there is a strong “edge” effect from adjacent habitats.

There are over 150 patches of coastal forest in Tanzania, most of which are less than 500 ha in size. Yet as regards the patterns of endemism of plants, the coastal forests have higher numbers of endemic species (0.015 endemics per sq km) than Eastern Arc forests (0.067) or even the huge Zaire Central African forests (0.003) (Rodgers, 1996). Clearly the coastal forests of eastern Africa generally, and specifically those of Tanzania, rank high as “hotspots” of endemism for plants. Less detailed information is available for various animal groups.

Among the invertebrates, only a few groups have received the attention of taxonomists; these include terrestrial snails, butterflies and millipeds. Studies on millipedes suggest that there are numerous coastal forest endemics, with many as yet undescribed species and genera known from only one or two forest patches.

Vertebrate species diversity and endemism in coastal forests is also important; collections made by Frontier-Tanzania (a cooperative effort between the Society for the Environmental Exploration, UK and the Faculty of Science, University of Dar es Salaam) over the past ten years have revealed the presence of at least two species of dwarf day-geckos in the genus *Lygodactylus* new to science as well as two new skinks. One of these was found only in the southern coastal forests and the other on Mafia Island and a few forest patches on the mainland. In addition, these surveys in Tanzania have found a new species of toad and a new species of thread snake in the genus *Leptotyphlops* all endemic to coastal forests.

It is the need to manage and conserve the remaining small coastal forest patches as part of Tanzania’s overall biodiversity conservation strategy that necessitates further survey and study. This is especially the case for those species which are endemic to Tanzania’s coastal forests, i.e., are found nowhere else in the world.

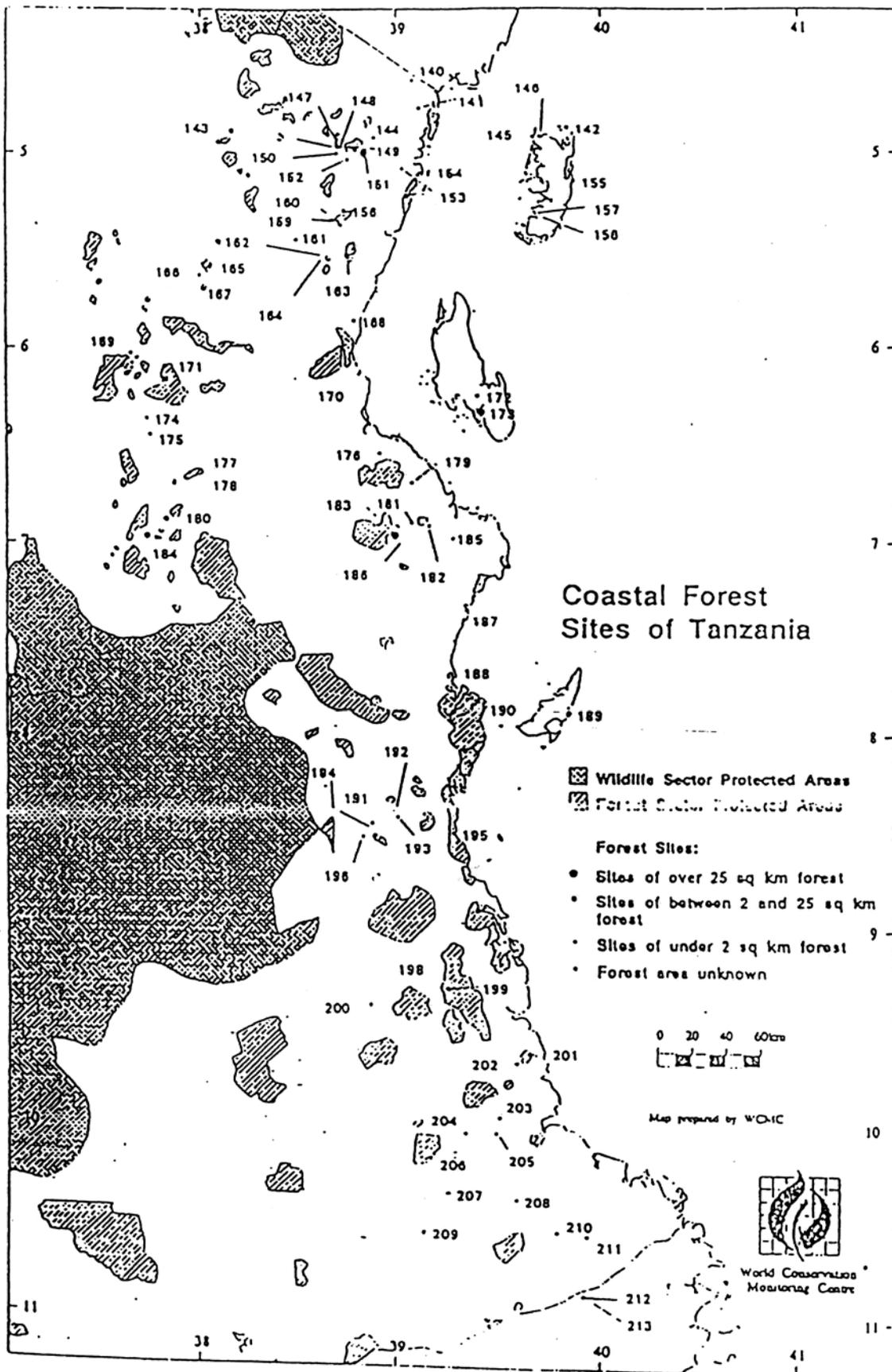


Figure 1: Distribution of Coastal Forests in Tanzania (after Burgess & Muir, 1994)

1.5 Biodiversity information needs for conservation and management of the Tanzanian coastal forests

Managing and conserving highly fragmented patches of forest is a task made more difficult by lack of precise information as to which areas have highest diversity and endemism, and information on species' precise ecological requirements.

Recently, considerable interest has been generated in attempting to use species diversity and endemism in a particular animal group (usually one which is relatively well-known taxonomically, such as birds or butterflies) as a measure against which to "score" various areas and reserves and compare them to select and prioritise areas for conservation and management efforts (Muriuki et al, 1997). However, such approaches have many drawbacks (Lombard, 1995; Williams, Burgess & Rahbek, 1997). Similarly, "...the use of only one or a limited number of indicator taxa to predict changes in richness of other groups may be high misleading and hence are unlikely to show similar responses to even major changes in habitat" (Lawton et al, 1998: 73).

Nevertheless, the need to obtain baseline data about species diversity and endemism in coastal forest patches is critical in setting priorities for management and conservation. So too is the need to establish ecological monitoring protocols to measure the effects of "Integrated Conservation and Development Programmes" (ICDPs) the goals of which are often stated to include biodiversity conservation but which often in the past have not included any objective method of assessing these (Kremen, Merenlender & Murphy, 1994).

There are special problems associated with the management and conservation of small areas (Schafer, 1995; Howell, 1994) Recently for example, some authors have introduced the concept of "irreplaceability" as a biodiversity value. If this is accepted, then each of the forest patches of the coastal system urgently needs to be surveyed and assessed (Pressey, Johnson & Wilson, 1994).

The need to obtain information on the biodiversity importance of forest patches within the project area prompted this study. Such information will allow priorities to be set as to which areas have highest species diversity and endemism values and form one set of criteria among many others which will help to develop management and conservation strategies for the coastal forests within the area of REMP.

1.6 Terms of Reference

The Eastern African Regional Office of the World Conservation Union (IUCN) and the Government of the United Republic of Tanzania developed the Rufiji Environmental Management Project (REMP). To assist in the assessment of the biodiversity values of selected sites within the project area, the Department of Zoology & Marine Biology, University of Dar es Salaam, was contracted to conduct a biodiversity survey of areas identified as of potentially high biodiversity value and significance. Simultaneously, the Department of Botany of the University of Dar es Salaam was similarly contracted to assess vegetative biodiversity values.

The following terms of reference were developed after discussions with the then CTA Mr. A. Graham.

- The aim is to provide the Rufiji District Council with a comprehensive list of the small vertebrate (i.e., non - large mammal) species of two sites within the project area, the Weme site and the Kichi Hills site, based on existing literature, other records, and the programme of field observations and collections.

In addition:

- Any biodiversity "hotspots" present are to be identified;
- The study is to identify species or groups present, the status of which may serve as indicators of environmental condition;
- A long-term programme of observations is to be designed that would yield sufficient information to monitor their status
- A report covering the categories of information available and highlighting any notable features of the biodiversity of the project area is to be prepared.

2 The Study Sites

A. Graham had previously identified four sites of potential high biodiversity interest. These were:

1. Weme site, an area of riverine forest 20 km southeast of Utete;
2. The Kichi Hills site, near Kungurwe village, approximately 40 km south of Utete;
3. Namakutwa Forest Reserve, 30 km south of the Nyamwage road junction, and;
4. An un-named swamp about 40 km west of Utete (see Figure 2).

Due to limitations of time, and because at least some sampling had previously been conducted at the Namakutwa site, site 1, Weme and site 2, Kichi Hills, were given priority during the current sampling programme.

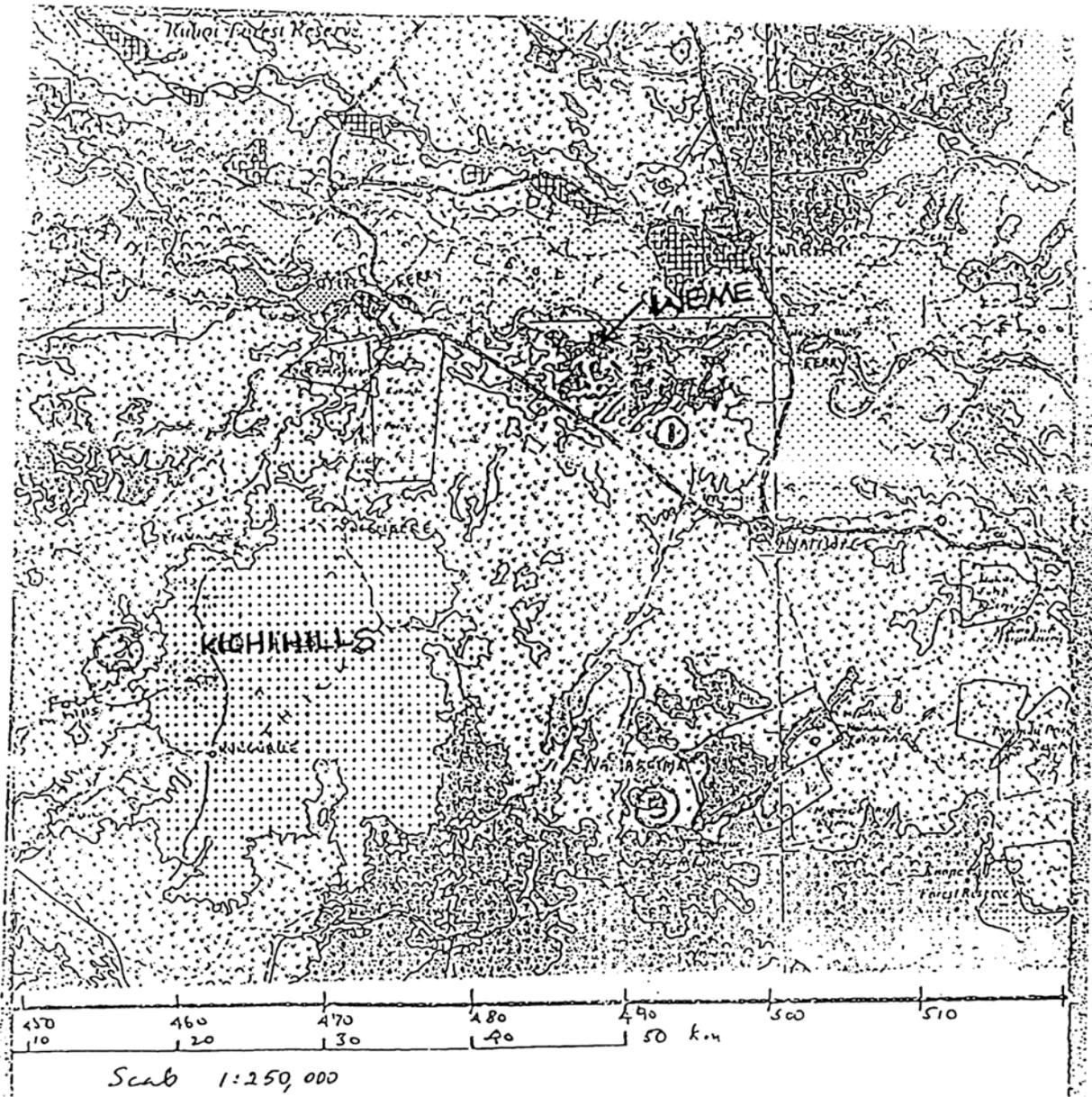


Figure 2: Study site locations.

1. Weme; 2. Kichi; 3. Namakutwa; 4. An un-named swamp app. 20 km northwest of the Kichi site (not visible on this map).

2.1 Weme Site

Base camp was established at Weme (camp coordinates 08° 02' 2.9"S, 38° 54' 08.8"E) on 15 February 2000. BPFLs and associated and similarly numbered snap and live trap lines were established (See Table 1); trapping continued through 23 February.

Table 1: Coordinates for BPFL and associated snap and live trap lines, Weme Site

BPFL number	Habitat	South Latitude	East Longitude
BPFL1	Grassland at the edge of Lake Weme	08° 02' 28.6"	38° 54' 06.6"
BPFL2	50 m inside forest near base camp	08° 02' 35.2"	38° 54' 10.5"
BPFL3	300 m inside forest from the edge of Lake Weme	08° 02' 35.8"	38° 54' 05.1"
BPFL 4	500 m inside forest from the edge of Lake Weme	08° 02' 39.5"	38° 53' 59.8"
BPFL 5	Woodland	08° 02' 44.9"	38° 54' 14.0"
BPFL 6	Woodland	09° 02' 41.7"	38° 54' 23.4"

2.2 Kichi Hills

Base camp was established at the Kichi Hills site on 26 February 2000 (camp coordinates approx. the same as BPFL 1). BPFLs and associated and similarly numbered snap and live trap lines were established (See Table 2); trapping continued through 3 March 2000.

Table 2: Coordinates for BPFL and associated snap and live trap lines, Kichi Hills Site

BPFL number	Habitat	South	East
BPFL1	Disturbed, regenerating forest in valley near base camp at Kungurwe village	08° 18' 03"	38° 39' 06.1"
BPFL2	200 m east of BPFL1 in regenerating thicket, abandoned shamba. Closed thicket with tangles and climbers.	GPS unable to take reading	
BPFL3	Secondary forest regeneration from old settlements south of Kungurwe village. Closed canopy and open or clear understory with very little leaf litter and undergrowth.	08° 16' 43.2"	38° 39' 10.4"
BPFL 4	as for BPFL3	08° 16' 38.5"	38° 39' 10.2"
BPFL 5	Highest point in Kichi Hills app. 300 m asl. (also known as Mking hill or Chumanii land mark); closed forest with only a few large trees; area highly disturbed by elephants in the wet season; Undergrowth herbaceous.	08° 12' 46.2"	38° 38' 38.4"
BPFL 6	as for 5	08° 12' 47.3"	38° 38' 38.5"

3 Methods and Rationale

The choice of methods utilised for any particular study/sampling programme is dependent on its goals. In this case, it was assumed that in addition to simply determining presence or absence of species, a method which would enable later comparison with these initial baseline results would be most suitable, i.e., methods which would permit future replication and thus monitoring. Any such methods should be relatively easily to duplicate, and should also have as little as possible observer bias, since it is most unlikely that the same individuals would be involved in future monitoring over long periods of time. Ideally, at least some of these methods should also be able to be conducted by local community members, so that they can participate and understand the methods and how they are used, even if they lack the formal education necessary for the detailed taxonomic identification and analysis of the data.

Existing studies indicated that it is necessary to utilise more than one capture technique to obtain reasonably precise data on which species are present, and which are absent, from any particular site (Stanley, Goodman & Hutterer, 1996). Additionally, in many parts of East Africa, there is a strong seasonal affect from rainfall and its absence.

A variety of methods were selected which have already been proven successful in Tanzania and with which all of the participants were familiar. These methods have been used in habitats ranging from montane to lowland forest, coastal forest, woodland and seasonally flooded wetlands.

3.1 Small mammals

The general method was that of Stanley, Goodman & Hutterer (1996). A combined array of methods was used to sample small mammals (small rodents and shrews). Bats were not sampled as they require more labour and effort than was available. The traps included snap (break back) traps, Sherman live traps, and live traps designed by A. Graham. These traps were baited with roasted coconut cut into a standard size that had been rolled in peanut butter.

Bucket Pit Fall Traps set in arrays of BPFLs (Bucket Pit Fall Lines) were also used to sample small species and juveniles not adequately sampled by the other types of traps. These traps rely on animals falling into them and are not baited.

Snap traps

All-metal Snap traps (Chinese “Zlip” brand, 9 x 18 cm) were set in lines approximately 5 m apart, about 80% of these were set on the ground, the others were on vines and tree limbs up to about 1.5 m above ground level.

Live traps

Two types of live traps, “Sherman” type traps (24.5 x 8 x 9 cm) and two different sizes of “AG” live traps (designed by A. Graham and built by local craftsmen in Utete) were set; these traps were not set on lianes or tree branches. The larger of the AG trap measured 62 x 21 x 16 cm, and the smaller 31 x 11 x 10.5 cm.

Bucket Pit Fall Traps

Each Bucket Pit Fall Line (BPFL) consisted of eleven 20-litre buckets with small drainage holes cut in the bottom. Each bucket was 34 cm high and had an inside diameter of 31 cm across the top and 28 cm across the bottom. Each bucket was buried in the soil so that the rim was level with the ground. A long drift fence of plastic sheeting 0.5 m high and 55m long traversed the line and bisected each bucket.

Traplines and BPFLs were checked twice each day, once just after sunrise and again in the late afternoon, during re-baiting. Snap and live traps were baited daily. A trap or BPFL in use for a 24 hr period from sunrise to sunrise is referred to as a trap night or a bucket night.

Other sources of specimens and information: Any visual records such as sightings of animals, spoor, or indication from local residents that species were present, were also noted. Local residents also brought specimens.

Processing of specimens: Standard measurements were taken for each specimen, including total length, length of head and body, length of tail, length of hind foot (cu). Any obvious signs of reproduction were noted, such as lactation. Specimens were either prepared as study skins and skulls or preserved in 10% formalin. Each specimen was given a unique field number in the KMH series using pre-printed, numbered tags. Specimens will be catalogued in the Vertebrate Collection of the Dept. of Zoology & Marine Biology, University of Dar es Salaam. Where necessary, duplicates will be sent to the appropriate specialists to confirm identifications. All specimen numbers and associated data have been entered into the Biodiversity Database, Department of Zoology and Marine Zoology, University of Dar es Salaam in Microsoft Access.

3.2 Amphibians and Reptiles

Anurans (frogs and toads) are most active at night and most noticeable when males are vocalising. Visual searching for vocalising individuals is the most productive method of locating and capturing males. Audio tape recordings of vocalisations were also made for later analysis and identification.

Leaf litter dwelling amphibians as well as those which may be moving to or from aquatic breeding sites can be effectively sampled using Bucket Pit Fall Traps. A single species of legless amphibian (common names: Apodan, Caecilian and Gymnophionan) is known to occur in damp soil near freshwater in the vicinity of the Rufiji river and potentially, it too should have been sampled by the pitfall trap method. In contrast, treefrogs (family Hyperoliidae) and foam nest frogs (family Rhacophoridae) are not adequately sampled using this technique.

Visual searching, including the examination of hiding sites such as under logs, rocks, and in other crevices, was also conducted. Methods used to sample reptiles, which are generally more diurnal than amphibians, included visual searches, examining sites of concealment (under stones, logs, etc.), and requesting local residents to bring specimens to the survey camp. Bucket Pit Fall Traps are also successful in capturing smaller, ground dwelling reptiles and burrowing reptiles that are only active on the surface of the ground at night. However, BPFTs are not suitable for sampling large reptiles such as large monitor lizards or snakes, or highly arboreal forms.

Processing of specimens: Standard measurements of snout-vent length and length of tail were recorded, as appropriate. Colour notes were taken as appropriate. When it was possible to determine the sex of an individual (in amphibians, for example, through presence of eggs, or elongated digits) this was done and noted. In the case of reptiles, any male specimens had its hemipenes expressed and injected with 10% formalin. Each specimen was given a unique field number in the KMH (series) using pre-printed numbered tags. Reptiles were preserved in 10% formalin, amphibians in 70% ethyl alcohol. Specimens will be catalogued in the Vertebrate Collection of the Dept. of Zoology & Marine Biology, University of Dar es Salaam. If necessary, duplicates will be sent to the appropriate specialists to confirm identifications.

All specimen numbers and associated data have been entered into the Biodiversity Database, Department of Zoology and Marine Zoology, University of Dar es Salaam in Microsoft Access.

3.3 Other groups

Selected invertebrate groups, molluscs, crustaceans (freshwater crabs) and diplopoda (millipeds) were sampled by searching for these on vegetation (molluscs) both during the day and at night and sampling with pitfall traps (crustaceans and millipeds).

4 Results

4.1 Small Mammals

The species captured and type of trap(s) in which each was taken are indicated in Table 3.

Table 3: Small mammals captured and trap type used.

(Snap and live traps were considered as one type, BPFLs another)

Species	Weme 16-24 Feb 2000		% catch by trap type	Kichi Hills 25 Feb-03 March 2000		% catch
	Trap type	Number of individuals		Trap type	Number of individuals	
Insectivora						
<i>Crocidura</i> sp.	Pitfall	3	3/5 = 60.0%	Pitfall	5	5/8=62.5%
Rodentia						
<i>Acomys spinosissimus</i>	Sherman AG	1 2	3/7 = 4.28%	Snap	3	3/5=60.0%
<i>Beamys hindei</i>	Pitfall	1	1/5 = 20%	Pitfall	1	1/8=12.5%
<i>Grammomys</i> sp.	-			Snap Pitfall	1 1	1/5=20% 1/8=12.5%
<i>Lemniscomys rosalia</i>	Snap	2				
<i>Mus minutoides</i>	Pitfall	1	1/5 = 20%	Pitfall	1	1/8=12.5%
<i>Paraxerus</i> sp.	Snap	1	1/7 = 14.28%	Snap	1	1/5=20%
<i>Tatera</i> sp.	Snap	1	1/7 = 14.28%	-	-	-

**Rhynchocyon petersi*, the Red and black elephant shrew, was snared in the Kichi Hills by local children and brought to camp.

** *Nycteris* sp. a Slit-faced Bat, was taken in a snap trap in Kichi Hills. It is not included here for analysis because bats are infrequently caught in snap traps.

While a number of species typical of coastal forest were not detected during this sampling, this does not mean they were absent; as noted in the discussion, conditions were apparently not conducive for many species to be active. Of interest, given the high level of disturbance in the vicinity of both sites (fishing at Weme, agriculture at Kichi) was the absence of: *Mastomys natalensis*, the Multi-mammate Mouse, a common "field rodent" often found in disturbed forest; and the absence of *Rattus rattus*, the Roof or Black Rat, a commensal of man in almost every village and town in Tanzania.

Table 4: Trapping Success Rate, Small Mammals

Site, Trap type and effort	No. of rodents	No. of shrews	Total	Success
Weme Site				
BPFL nights: 506	2	3	5	5/506 = 0.99%
Snaps and live traps: 723	7	0	7	7/723 = 0.97%
Kichi Site				
BPFL nights: 396	3	5	8	8/396 = 2.0%
Snaps and live traps: 579	5	0	5	5/579 = 0.86%

Note the low trap success rate which is often a feature of trapping in Tanzanian forests. The snap and BPFL rates are slightly lower than the usual 1-2% encountered elsewhere (Howell, pers.obs.).

4.2 Species list of mammals captured with comments on distribution and conservation status

Order Insectivora, Insectivorans

Family Soricidae: White-toothed or Musk Shrews

Crocidura sp. **White toothed or Musk Shrew**

Only a single species in this genus was collected. The identification of most shrews requires a detailed study of dental structure and very few taxonomists currently study African shrews. Many species are widespread, but others are endemic to isolated forests, especially those of the Eastern Arc. As far as is known, no species of shrew has been found to be endemic to a coastal forest in Tanzania.

Order Macroscelidea, Elephant Shrews

Family Macroscelididae: Elephant Shrews

Rhynchocyon petersi **The Red and Black Elephant Shrew**

This species is found in Eastern Arc and coastal forests in eastern Africa. Concern has been expressed for its conservation. IUCN (1996) regards this species as EN (Endangered). It is threatened by the alteration, fragmentation and loss of closed forest habitat. If dense forest or thicket is present nearby to act as a refuge, they are able to survive in areas where non-intensive agriculture is practiced (pers. observation, KMH, Mafia Island) but it would appear that these “edge” populations cannot survive without the presence of thicket and forest.

Kingdon (1974, 1998) notes that hybridization may occur in coastal Tanzania between *R. petersi* and *R. cirnei*, the latter is listed by IUCN (1996) as Vulnerable and faced with threats similar to those for *R. petersi*. The single specimen collected appears to have characteristics of both of these species (head pattern and colour resemble *R. cirnei*, as do very faint pale longitudinal lines of light coloured blotches along back and sides of body; back and sides a deep red-black, features of typical *R. petersi*).

Order Rodentia the Rodents

Family Muridae Rats and Mice

Acomys spinosissimus **Red Spiny Mouse**

Members of this genus are widespread in eastern Africa. They are often but not always associated with rocky outcrops, especially in edge situations. Not a true forest dependent species.

Beamys hindei **Lesser Pouched Rat**

The Lesser Pouched Rat and its close relative, the African Giant Rat *Cricetomys gambianus* are sometimes placed in a separate family split off from the Muridae, the Cricetidae. Until relatively recently, *Beamys hindei* was regarded as sparsely distributed and difficult to trap. However, within the past ten years workers in Kenya and Tanzania (FitzGibbon, Leirs & Verheyen, 1995; Frontier-Tanzania, unpublished; Stanley, unpublished; Howell, 1996) have found that it is widely distributed in both Eastern Arc and coastal forests and can be captured using standard trapping techniques. It does seem to be forest dependent and has not been trapped in open vegetation or dry woodland, but may be expected in riverine forest and thicket near forest. IUCN (1996) lists its status as VU (Vulnerable)

Grammomys sp. **Narrow-footed Woodland Rat**

The genus *Grammomys* presents a number of difficulties as regards identification. Two species, *G. macmillani* and *G. dolichurus* may be present and these are not always easy to distinguish. The REMP project area may include both species; the animal collected has been tentatively identified as *G. dolichurus*. The genus is widespread and found in a variety of habitats, from primary to disturbed forest.

Lemniscomys rosalia **Striped Grass Mouse**

Striped Grass Mice are widespread grassland and woodland species and would be expected to occur in large numbers in these habitats in the REMP project area, especially at the Weme site.

Mus minutoides **Pigmy Mouse**

This species is widespread and is not strictly forest dependent.

Tatera sp. **Naked-soled Gerbil**

Gerbils are species typical of woodland and grassland and are not associated with forest. They are another difficult group to identify with certainty to the species level without large comparative series of specimens from both the study area and other sites. Two species might be present, *T. leucogaster* and *T. robusta*.

Order Rodentia

Family Sciuridae Squirrels

Paraxerus (?) *palliatu*s **Red Bush Squirrel**

Squirrels are widespread but usually not abundant in coastal forest or woodland. It is unusual to obtain squirrels in standard snap traps; in six years of trapping (some ten thousand or more trap nights of effort) in a wide variety of habitats in Tanzania, including coastal forest, we have taken few squirrels. The taxonomy of East African squirrels remains unsettled making identification to the species level difficult. IUCN (1996) give its status as **VU** (Vulnerable).

Table 5: Other mammals recorded or reported from the study sites

(L=reported as present by local residents)

Name	Weme Site	Type of record	Kichi Site	Type of record
Proboscidea: Elephantidae				
Elephant <i>Loxodonta africana</i>	Four	Sight	Two	Sight
Artiodactyla: Bovidae				
Buffalo <i>Syncerus caffer</i>	Present	L	Present	L
Greater Kudu <i>Tragelaphus strepsiceros</i>	Present	Sight	Not seen	
Common Duiker <i>Sylvicapra grimmia</i>	Present	Sight	Present	Sight
Artiodactyla: Suidae				
Bushpig <i>Potamochoerus porcus</i>	Present	Sight	Present	Sight
Warthog <i>Phacochoerus africanus</i>	Present	Sight	Not seen	
Artiodactyla: Hippopotamidae				
Hippopotamus: <i>Hippopotamus amphibius</i>	Present	Seen, heard	Not seen, unlikely due to terrain and distance from water	
Order Primates: Cercopithecidae				
Sykes or Blue Monkey <i>Cercopithecus mitis</i>	Present	Seen	Present	Seen
Vervet Monkey <i>Cercopithecus pygerythrus</i>	Present	Seen	Not seen	
Baboon: <i>Papio cynocephalus</i>	Present	Seen	Present	Seen
Order Primates: Galagonidae				
Bushbabies: Two types, a larger species and a smaller one.	Present	Seen, heard	Present	Seen, heard
Order Carnivora: Felidae				
Lion <i>Panthera leo</i>	Present	Heard roaring	Present	L
Leopard. <i>Panthera pardus</i>	Present	L	Present	L

4.3 Birds

Although birds were not sampled by the trapping regime, single individuals of two species in the order Passeriformes were taken in snap traps, *Pitta angolensis*, the African Pitta, and *Camaroptera brachyura*. The African Pitta (family Pittidae) is an Intra-African migrant that regularly moves along the forests and thicker woodlands of the East African coast as well as further inland. According to Britton (1980) it breeds in dense thickets in southeastern Tanzania, probably including the study area, between December and April. The species migrates as far north as the forests of Southern and Western Uganda and to forest in the vicinity of the Gedi Ruins, coastal Kenya. It passes through forests of coastal Tanzania as well as those of the Eastern Arc mountains at Mufindi .

The *Camaroptera* (family Sylviidae) is a common species of thicket and forest. Although it is usually regarded as a gleaner on vegetation, it is also known to favour low vegetation near the ground, and so its capture in a snap trap is perhaps not unexpected. Nevertheless, this is the first time this species has been taken in a snap trap in more than ten years of trapping in forest.

Trapping with snap traps in the Eastern Arc forests usually results in the capture of forest thrushes (Passeriformes: Turdidae) rather than sylviiids. This is also true of coastal forests; Howell (1997) for example, reported the capture of the Red-capped Robin Chat *Cossypha caffra* and Eastern Bearded Scrub-Robin *Cercotrichas quadrivirgata* in snap traps at Pugu forest during small mammal surveys.

4.4 Amphibians

Twelve species of anuran amphibians (frogs and toads) were captured using BPFLs. No species of legless amphibian (Apodan) was detected at either Weme or Kichi sites (Table 6). Five non-forest species of widespread distributions were trapped at Weme which were not taken at Kichi: *Hildebrandtia ornata*, *Phrynobatrachus acridoides*, *Phrynobatrachus mababiensis*, and *Ptychadena mossambica*, all in the family Ranidae, and a member of the Hemisotidae, *Hemismus marmoratum*.

In contrast, at the latter site, two species of small toad endemic to the eastern African coastal forests, *Mertensophryne micranotis* and *Stephopaedes loveridgei* were taken; these were absent at Weme. The two sites shared only two species as sampled using BPFLs: *Arthroleptis stenodactylus* and *Breviceps mossambicus*. Although these are not strictly forest-dependent throughout their wide ranges, they are often associated with forest in coastal forests of Tanzania.

Table 6: Number of individuals and per cent composition of amphibians captured in BPFLs.

Species	Weme 16-24 Feb 2000	Kichi Hills 25 Feb-03 March 2000
Anura		
Bufonidae		
<i>Bufo gutturalis</i>	35/441=7.9%	0
<i>Bufo lindneri</i>	06/441=1.3%	0
<i>Mertensophryne micranotis</i>	0	02/161=1.2%
<i>Stephopaedes loveridgei</i>	0	16/161=9.9%
Microhylidae		
<i>Breviceps mossambicus</i>	6/441=1.3%	15/161=9.3%
Arthroleptidae		
<i>Arthroleptis stenodactylus</i>	139/441=31.5%	125/161=77.6%
<i>Schoutedenella xenodactyloides</i>	0	3/161=1.86%
Ranidae		
<i>Hildebrandtia ornata</i>	4/441=0.9%	0
<i>Phrynobatrachus acridoides</i>	5/441=1.13%	0
<i>Phrynobatrachus mababiensis</i>	75/441=17%	0
<i>Ptychadena mossambica</i>	01/441=0.2%	0
Hemisotidae		
<i>Hemismus marmoratum</i>	170/441=38.5%	0
Total	441	161

The two sites also different in the composition of the catch.. At Weme, the two dominant species were *A. stenodactylus* (31%) and *Hemismus marmoratum* (38.5%), while at Kichi, *A. stenodactylus* made up more than 77.5% of the total catch.

Because of the larger numbers of amphibians compared to mammals or reptiles, the trap success of numbers of individuals was much greater (See Table 7 and relevant sections of this report).

Table 7: Trapping Success Rate, Amphibians

Site, Trap type and effort	No. of amphibians	Trap Success
Weme Site		
BPFL nights: 506	441	87%
Kichi Site		
BPFL nights: 396	161	40.6%

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

Amphibians sampled by hand (Table 8) included those which were searched for during night time audio surveys as well as those encountered during the daylight hours. One species at each site, *Afrivalus brachycnemis* at Weme and *Chiromantis xerampelina* at Kichi were taken only by hand collecting. Neither is a forest dependent species.

Vocalising amphibians detected during audio surveys are indicated in Table 8 and 9. Five species were detected using this technique which were not found using any other method.

Table 8: Number of individual amphibians captured by hand

Species	Weme 16-24 Feb 2000	Kichi Hills 25 Feb-03 March 2000
	Number of individuals	Number of individuals
Anura		
Bufonidae		
<i>Mertensophryne micranotis</i>		1
<i>Stephopaedes loveridgei</i>		1
Rhacophoridae		
<i>Chiromantis xerampelina</i>		1
Microhylidae		
<i>Breviceps mossambicus</i>		1
Hyperoliidae		
<i>Afrivalus brachycnemis</i>	1	

Table 9: List of all amphibians detected at the two study sites and those detected by audio survey: + = heard

Species	Weme	Kichi Hills
Bufonidae		
<i>Bufo gutturalis</i>	+	
<i>Bufo lindneri</i>		
<i>Mertensophryne micranotis</i>		
<i>Stephopaedes loveridgei</i>		
Rhacophoridae		
<i>Chiromantis xerampelina</i>		+
Microhylidae		
<i>Breviceps mossambicus</i>	+	
Arthroleptidae		
<i>Arthroleptis stenodactylus</i>		
<i>Schoutedenella xenodactyloides</i>	+	
Ranidae		
<i>Hildebrandtia ornata</i>		
<i>Phrynobatrachus acridoides</i>	+	
<i>Phrynobatrachus mababiensis</i>	+	
<i>Ptychadena anchietae</i>	+	
<i>Ptychadena mossambica</i>		
Hemisotidae		
<i>Hemisis marmoratum</i>		
Hyperoliidae		
<i>Afrivalus brachycnemis</i>	+	
<i>Afrivalus fornasinii</i>	+	
<i>Leptopelis flavomaculatus</i>	+	
<i>Hyperolius mitchelli</i>	+	
<i>Hyperolius parkeri</i>		
<i>Hyperolius tuberilinguis</i>	+	

The drier conditions at the Kichi site were not conducive to vocalising for frogs and toads, and only a single species was heard there. This finding indicates how sites not physically separated by a great distance may nevertheless show very different physical and ecological characteristics which in turn affect their biodiversity.

Species list of amphibians detected with comments on distribution and conservation status

Bufonidae: Toads

Bufo gutturalis, **the Guttural Toad**

A common, widespread species throughout much of eastern Africa.

Bufo lindneri, **Lindner's Dwarf Toad**

Although at one time thought to be rare and possibly even restricted to forest and therefore threatened by clearance, this species has since been shown to be more widespread and has been found in woodland, and on land under small-scale cultivation as well as in coastal forest. While it appears to be nowhere common, it is probably overlooked. See Clarke (1988) for details.

Mertensophryne micranotis **Dwarf Earless toad**

This species appears to be found mostly in coastal forest but with a few populations occurring at higher elevations reported many years ago.. Formerly a separate subspecies, *M. micranotis rondoensis* was named for the southern Tanzanian populations, but this is no longer recognised (Poynton, 1991). This species is a good climber and lays its eggs in water trapped in tree bark and crevices above ground level, and also sometimes in empty snail shells.

Although not included in IUCN (1996), it may be regarded as Vulnerable to threats from forest fragmentation and habitat alteration.

Stephopaedes loveridgei **Loveridge's Stephopaedes**

The genus *Stephopaedes* was only recently split off from *Bufo* on the basis of its unique tadpole morphology. Members of the genus are found in eastern and southeastern Tanzania, ranging from forests in the Kiwengoma area, the Rondo Plateau to Mafia Island and Kwangumi Forest Reserve in the East Usambara mountains.

S. loveridgei is known from the Rondo area, Kiwengoma Forest, Kichi Hills (this study) and Ulanga District. It appears to be forest dependent and thus is threatened by alteration and/or destruction of its forest habitat. *Stephopaedes loveridgei* is not included in IUCN (1996) but certainly is vulnerable to forest destruction and fragmentation

The genus *Stephopaedes* appears to be forest dependent and in the past has been overlooked. Two species new to science have recently been described. One, *S. howelli*, is known only from Mlola forest on Mafia Island. The other, *S. usambarae*, is known only from Kwangumi Forest Reserve and nearby small patches of forest in the East Usambara mountains. A third undescribed species is also probably present on Unguja island, Zanzibar. Outside of Tanzania, *S. anotis* occurs in Chirinda forest, Zimbabwe. See Poynton & Clarke (1999) for a review of the genus and its relationship with other small toads of coastal forests.

Rhacophoridae: Foam Nest Tree Frogs

Chiromantis xerampelina **Gray Foam Nest Tree Frog**

This is a widespread species over much of eastern Africa. It is not associated with forest, but rather with woodland and open habitats. It is unusual in that it makes a nest of a white "foam" produced by the

female and beaten into a froth with her legs as well as those of several males who may be in attendance. The fertilised eggs are placed in the centre of the foam, which then becomes hard and brittle on its exterior. The eggs remain in this nest, which is in vegetation above water. When the tadpoles emerge, the nest disintegrates and they drop into the water below and continue their growth until metamorphosis. This species is not of conservation concern.

Microhylidae: Microhylid frogs

Breviceps mossambicus **Mozambique Rain Frog**

This species as its name suggests is widely distributed. However, it is not frequently seen. Adults spend most of the time in burrows and only emerge after heavy rain. Unlike most amphibians, its eggs are laid not in water, but underground in a moist burrow. While not strictly forest dependent, on the Tanzanian coastal strip it may be dependent on the cover and moist conditions provided by coastal forests in the dry season.

Arthroleptidae: Bush Squeakers

Arthroleptis stenodactylus **Bush Squeaker**

Members of this species are widespread in eastern and southern Africa and are not limited to forest in their distribution, but are also found in woodland and farmland.

Schoutedenella xenodactyloides **(There is no accepted common name for this species)**

Members of this genus are often placed in the genus *Arthroleptis* by some authors. They are common leaf litter frogs but may also be found at higher altitudes in more open areas, and this are not considered strictly associated with forest habitat.

Ranidae: “Typical frogs”

Hildebrandtia ornata **The Ornate Frog**

This species is a large ranid which is usually found in seasonally flooded wetlands in woodlands and open habitats. It is not typically a forest species but in the dry season, it may burrow in the soil of the forest floor.

Phrynobatrachus sp. **Puddle Frogs**

Members of this genus include the species listed below. None is a typically forest species. Generally these species are widely distributed in eastern and southern Africa. At least two species are present in the study area.

Phrynobatrachus acridoides **East African Puddle Frog**

Phrynobatrachus mababiensis **Dwarf African Puddle Frog**

Ptychadena anchietae **Plain Grass Frog**

This is a widespread species of grasslands and open habitats, not a forest species.

Ptychadena mossambica **Mozambique Grass Frog**

The Mozambique Grass Frog is a widespread species along the coastal strip. It is not strictly forest dependent and is found in a variety of habitats, including disturbed sites such as farmland.

Hemisotidae: Shovel-nosed frogs

Hemisis marmoratum **Mottled Shovel-nosed Frog**

This species is widespread in eastern and southern Africa. It is not forest dependent but it may depend on forest near breeding pools to survive the dry season.

Hyperoliidae: Treefrogs and Reedfrogs

Afrixalus brachynemis **Pigmy Leaf-folding Frog**

A species typical non-forest species of wetlands and grassland. Widespread in eastern Africa.

Afrixalus fornasinii **Greater Leaf-folding Frog**

A widespread, non-forest species in eastern and southern Africa.

Leptopelis flavomaculatus **Yellow-spotted Leptopelis**

This species is usually associated with forest and forest edge situations; widespread in eastern African forests.

Hyperolius mitchelli **Mitchell's Reedfrog**

A species often associated with lowland and coastal forests in eastern Africa but found in open ponds and wetlands rather than the interior of forests.

Hyperolius parkeri **Parker's Reedfrog**

This is typically a species of wetlands and edge situations, recorded from other coastal forests in Tanzania.

Hyperolius tuberilinguis **Tinker Reedfrog**

A non-forest species of grasslands and wetlands.

4.5 Reptiles

Reptiles sampled by BPFL trapping are indicated in Table 10. Relatively few individuals were so collected, but this method did successfully sample species that were not collected or detected using other techniques. The trapping success rate of 2% is comparable to that found elsewhere in Tanzanian forests (KMH, unpublished) (Table 11).

Table 10: Reptiles captured by BPFL trapping

Species	Weme 16-24 Feb 2000 Number of individuals	Kichi Hills 25 Feb-03 March 2000 Number of individuals
<i>Sauria:</i>		
Gekkonidae: Geckos		
<i>Cnemaspis</i> sp.	-	1
Scincidae: Skinks		
<i>Mabuya maculilabris</i>	1	
<i>Mabuya megalura</i>	1	
<i>Mabuya striata</i>	4	
<i>Panaspis wahlbergi</i>	5	
<i>Sepsina tetradactyla</i>	1	1
Cordylidae: Plated Lizards		
<i>Cordylus tropidosternum</i>		1
Snakes: Atractaspididae		
<i>Aparallactus jacksoni</i>	1	1
Colubridae		
<i>Crotaphopeltis hotamboeia</i>		1

Table 11: BPFL Trapping Success Rate, Reptiles

Site, Trap type and effort	No. of reptiles	Success
Weme Site		
BPFL nights: 506	13	13/506 = 2.5%
Snaps and live traps: 723	02*	
Kichi Site		
BPFL nights: 396	04	4/396 = 1.0%
Snaps and live traps: 579		

Single individuals of *Gerrhosaurus major* and *Varanus niloticus* were each taken in snap traps at the Weme Site. This is not a common occurrence and has not been recorded in some ten years of trapping in coastal and Eastern Arc forests. These results have therefore not been included in the trap success as they are regarded as anomalous; certainly snap traps do not adequately sample reptiles.

4.6 Other Reptile Records

Because some forms are large and/or extremely active, these types are less adequately sampled by BPFLs than the smaller forms. Other records of species included those collected by hand, of sight records (positively identified but the individual was not captured), photographic records, and local villager knowledge of certain easily recognised species or groups.

Table 12: Records of reptiles recorded by means other than by BPFL trapping.

Several species of reptiles were not sampled using BPFLs, but were collected by hand and/or with the assistance of local residents and others. These are detailed in the table. L = Reported as present by local residents.

Species	Weme 16-24 Feb 2000	Kichi Hills 25 Feb-03 March 2000
<i>Thelotornis capensis</i>	L	
Elapidae: Cobras and Mambas**		
<i>Naja mossambica</i>	L	
<i>Dendroaspis angusticeps</i>	L	
Viperidae: Vipers		
<i>Bitis arietans</i>	Sight	
<i>Causus defilippi</i>		By hand; specimen
<i>Bitis gabonica</i>		By hand; specimen

Note: A. Graham kindly provided specimens from the Utete area of * *Prosymna* sp. A Shovel snout and ** *Naja mossambica* (photograph). These would also be expected to occur at Weme and possibly also Kichi Hills.

4.7 Species list of reptiles detected with comments on distribution and conservation status

Sauria: Lizards

Gekkonidae: Geckos

Cnemaspis sp. Forest Geckos

Forest geckos are inconspicuous and often overlooked, but are usually detected using pitfall traps. Usually a single species, *C. africana*, is found in the lower elevation forests.

Hemidactylus mabouia Tropical House Gecko

This is a common species often living in association with humans. A closely related species the Baobab Gecko, *H. platycephalus*, is also likely to occur but has not yet been captured.

Lygodactylus sp. Dwarf Day-Geckos

The common species, *L. luteopicturatus*, the Yellow-headed Dwarf Day-Gecko, has been seen in Utete and probably occurs widely. However, at least one and possibly two much less common coastal forest endemics possibly occur, based on comparisons with Namakutwa and Kiwengoma forests. The East African Copal Gecko, *L. viscatus* could well occur; these day geckos are extremely cryptic and difficult to detect; they do not often enter pitfall traps.

Agamidae: Agamas

Agama mossambica, Mozambique Agama

This is a common species of the coastal strip and is often found in cultivation, in gardens, etc.

Chamaeleonidae: Chameleons

Chamaeleo dilepis: Flap-necked Chameleon

This is a widespread, common species and is found in a variety of habitats.

Cordylidae: Plated Lizards

Cordylus tropidosternum: **Spiny tailed Lizard**

This species is apparently restricted to coastal forest; it is usually overlooked in searches, but is taken in pitfall traps. It has been exported in increasing numbers for the live animal trade.

Gerrhosaurus major: **Plated lizard**

A widespread species not restricted to forest.

Varanidae: Monitor Lizards

Varanus niloticus **Nile Monitor**

A widespread, common species which is often found in large numbers near wetlands.

Varanus albigularis **Rock Monitor**

Reported outside the forested areas and likely to occur in woodland away from water.

Scincidae: Skinks

Mabuya maculilabris **Speckle-lipped Skink**

A widespread species usually found in forest or dense vegetation such as thickets.

Mabuya megalura **Grass-top Skink**

A species of grasslands, not a forest species.

Mabuya striata **Two-lined Skink**

A common widespread species.

Panaspis wahlbergii **Wahlberg's Snake-eyed Skink**

A common species in leaf litter in edge and woodland, not a forest-dependent species.

Sepsina tetradactylus **Four toed skink**

An apparently scarce species, but its scarceness is something which needs to be tested; it may simply be difficult species to detect. Known only from a few specimens in southeastern Tanzania. Probably somewhat forest dependent but little is known of its ecology and biology.

Boidae: Pythons

Python sebae **African Python**

Reported by local residents. Pythons often prefer moister areas and so might be expected to be more common at Weme site.

Viperidae: Vipers, Adders, etc.

Bitis arietans **Puff Adder**

A widespread species from outside of the forest.

Bitis gabonica **Gaboon Viper**

A large viper typical of forests. In Tanzania, known from Eastern Arc forests as well as those of the coast.

Causus defilippi **Snouted Night-Adder**

A common species, not forest dependent.

Elapidae: Cobras and Mambas

Dendroaspis angusticeps **Green Mamba**

Reported as common by local residents. This is an example of a species which is largely forest dependent, but which can also survive in edge and even suburban situations.

Dendroaspis polylepis **Black Mamba**

Not detected during the field work, but reported as present in woodland areas by local residents.

Colubridae: Typical snakes

Crotaphopeltis hotamboeia **Herald Snake**

A widespread species not found in forest. In forest at higher elevations replaced by *C. tornieri*, which is a forest species.

Aparallactus jacksoni **Jackson's Centipede Eater**

A widespread species of woodlands and other habitats, not a forest dependent species.

4.8 Other species

Probably due to the lack of rain, very few invertebrates were seen or were taken in the BPFLs. No terrestrial molluscs were observed or captured, and only two large millipeds of the widespread species *Archispirostreptus gigas* (Family Spirostreptidae) were collected. No freshwater crabs were taken in the BPFLs. Clearly this situation reflected the particular seasonal and weather conditions rather than a true absence of invertebrates.

5 Discussion

Each of the two sites sampled contains species of smaller vertebrates of conservation interest and concern. Records obtained by visual confirmation or indirectly (sign and anecdotal records from villagers) also indicate that larger mammal species of conservation concern are also present. Some of these are assigned various threat categories by IUCN (1996). These and other information on their conservation status is summarised in Table 13.

Table 13: Mammalian Species of Conservation Concern at Weme and Kichi Sites

Name	Conservation Status, Comment	Weme Site	Kichi Site
Proboscidea: Elephantidae			
Elephant <i>Loxodonta africana</i>	East African populations under threat; CITES Appendix I	Present	Present
Artiodactyla: Bovidae			
Greater Kudu <i>Tragelaphus strepsiceros</i>	Dependent on Continuing Conservation Activities for its survival	Present	Not seen
Artiodactyla: Hippopotamidae			
Hippopotamus: <i>Hippopotamus amphibius</i>	CITES Appendix II; usually numbers dwindle when nearby settlements.	Present	-
Order Primates: Galagonidae			
Bushbabies: <i>Otolemur crassicaudatus</i>		Present	Present
<i>Galagoides</i> sp. Possibly <i>zanzibaricus</i> and a new species not yet formally described	Probably Vulnerable to forest destruction	Present	Present
Order Carnivora: Felidae			
Lion <i>Panthera leo</i>	Vulnerable	Present	Present
Leopard <i>Panthera pardus</i>	CITES Appendix I	Present	Present
Order Rodentia: Muridae			
<i>Beamys hindei</i> Lesser Pouched Rat	Vulnerable		
Sciuridae			
<i>Paraxerus (?) palliatus</i> Red Bush Squirrel	Vulnerable		
Order Macroscelidea: Macroscelididae			
<i>Rhynchocyon petersi</i>	Vulnerable		Present

Among the reptiles, all chameleons (except, through an oversight, members of the genus *Rhampholeon*) are on CITES Appendix II, as are the Varanids and *Cordylus tropidosternum*.

5.1 Weme and Kichi sites Compared

The two sites differ in vegetation and topography, not surprisingly they also differ in animal species composition. However, it is necessary to point out that the samples represent only a single point in time and were not taken at a season of maximum animal activity and movement, especially as regards amphibians and invertebrates. Both of these groups were clearly under-sampled. This is suggested by the species accumulation curve, which has not yet flattened out (Figs 34-6). Experience in other Tanzanian forests suggests that small mammal trapping is greatly altered by rainfall and seasonal effects (Howell, 1996).

Figures 3,4,5 and 6 indicate trapping effort and results in terms of cumulative species accumulation and accumulated numbers of individuals for the two sites. The continued rise in the species accumulation curve would seem to indicate that several more nights of trapping might have produced still other species. Unfortunately for logistical reasons this was not possible.

The Kichi Hills site with its dense almost impenetrable thicket-like tangle of woody vegetation was very different in appearance from any other Tanzanian coastal forest so far surveyed (see vegetation report for details). It is perhaps this structure, as well as its rising elevation, which favoured the presence of two species of coastal forest toads, *Mertensophryne micranotis* and *Mertensophryne loveridgei* which were absent at Weme. The more open habitat at the latter site favoured more edge species such as the Grass-top Skink, *Mabuya megalura*.

Both forests probably play an important role as refuges for non-forest dependent amphibians. At other forest sites in Tanzania, the forests have been shown to be critically important as refuges for adult amphibians which breed in seasonal pools in more open areas, but which migrate up to a kilometre back to the forests. The juveniles of these species also make use of the forest to hide during the dry season (Msuya in prep.).

More data are needed from villagers and Wildlife Division staff to be able to evaluate the importance of these two sites to large mammals. However, discussions with villager suggest that in the wet season, large mammals make use of the Kichi Site, and elephants were present at both sites during the sampling.

Mammals such as bats have yet to be sampled in detail at these two sites. Similarly, elephant shrews and small to medium sized carnivores also have not been adequately sampled. Both of these groups contain species of potential interest in terms of endemism and forest dependence, but are difficult to sample without large time and manpower commitments. Primates have not been sampled quantitatively, and the nocturnal primates will require specialists trained in their identification and survey techniques. .

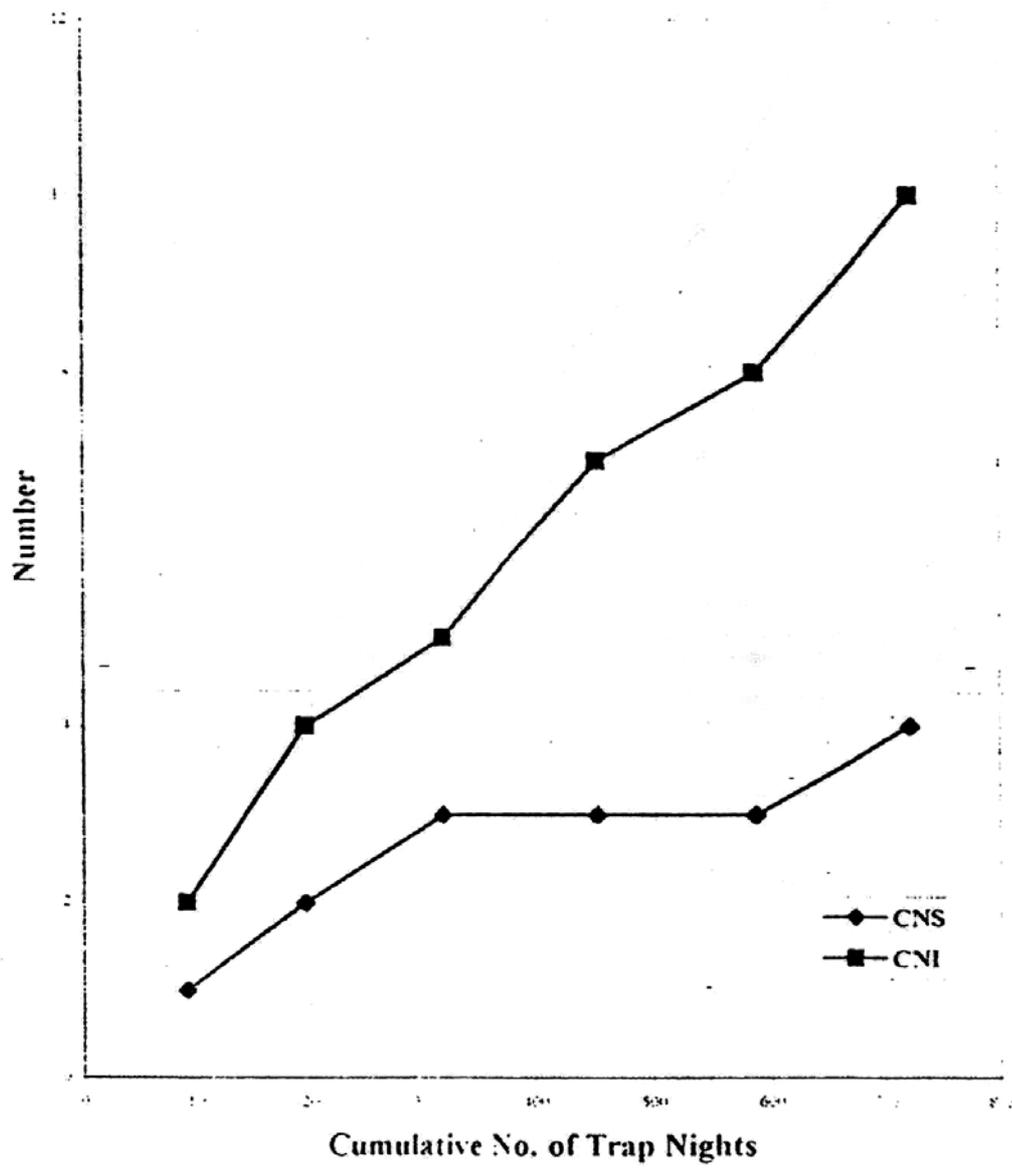


Figure 3: Cumulative Number of Species and Cumulative Number of Individuals taken using Snap and Live Traps at Weme Site.

CNS= Cumulative Number of Species CNI = Cumulative Number of Individuals

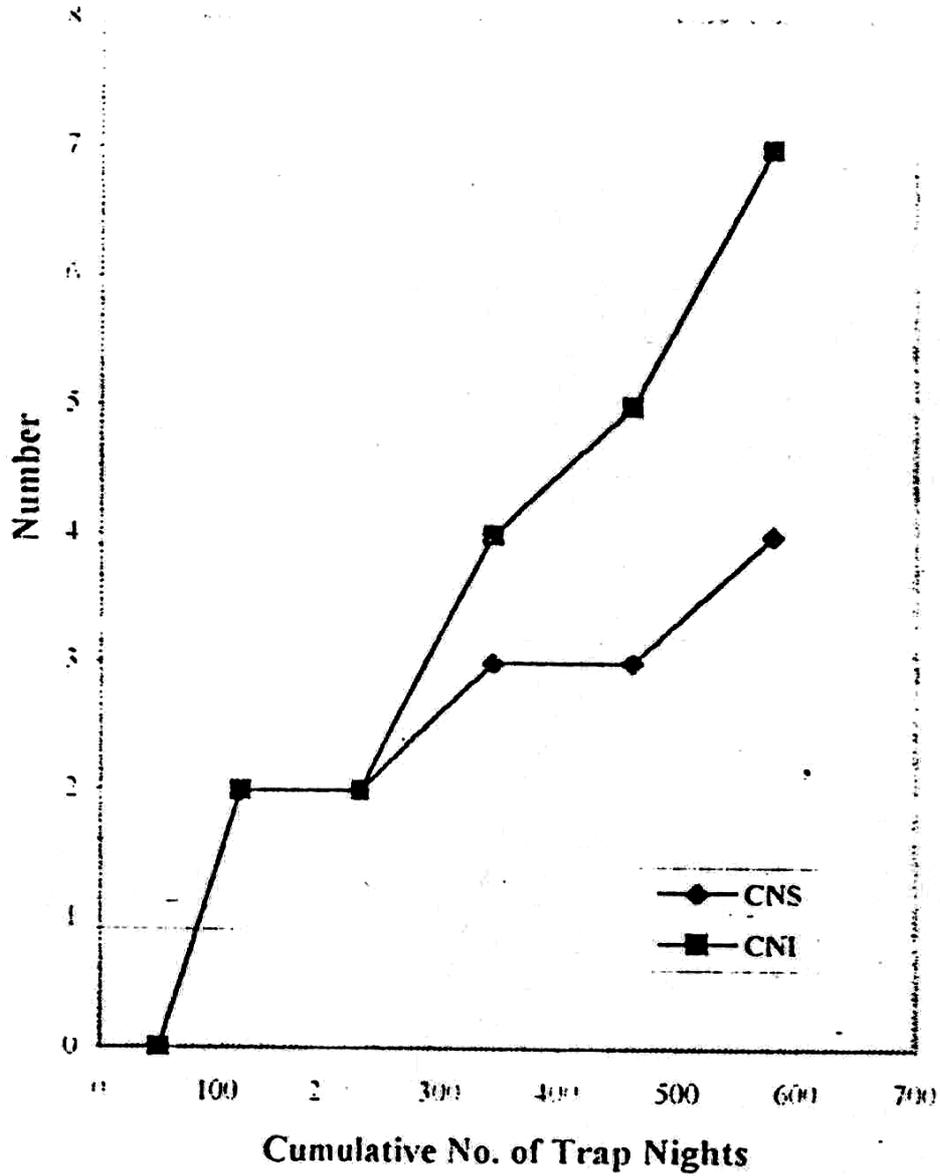


Figure 4: Cumulative Number of Species and Cumulative Number of Individuals taken using Snap and Live Traps at Kichi Site.

CNS= Cumulative Number of Species
CNI = Cumulative Number of Individuals

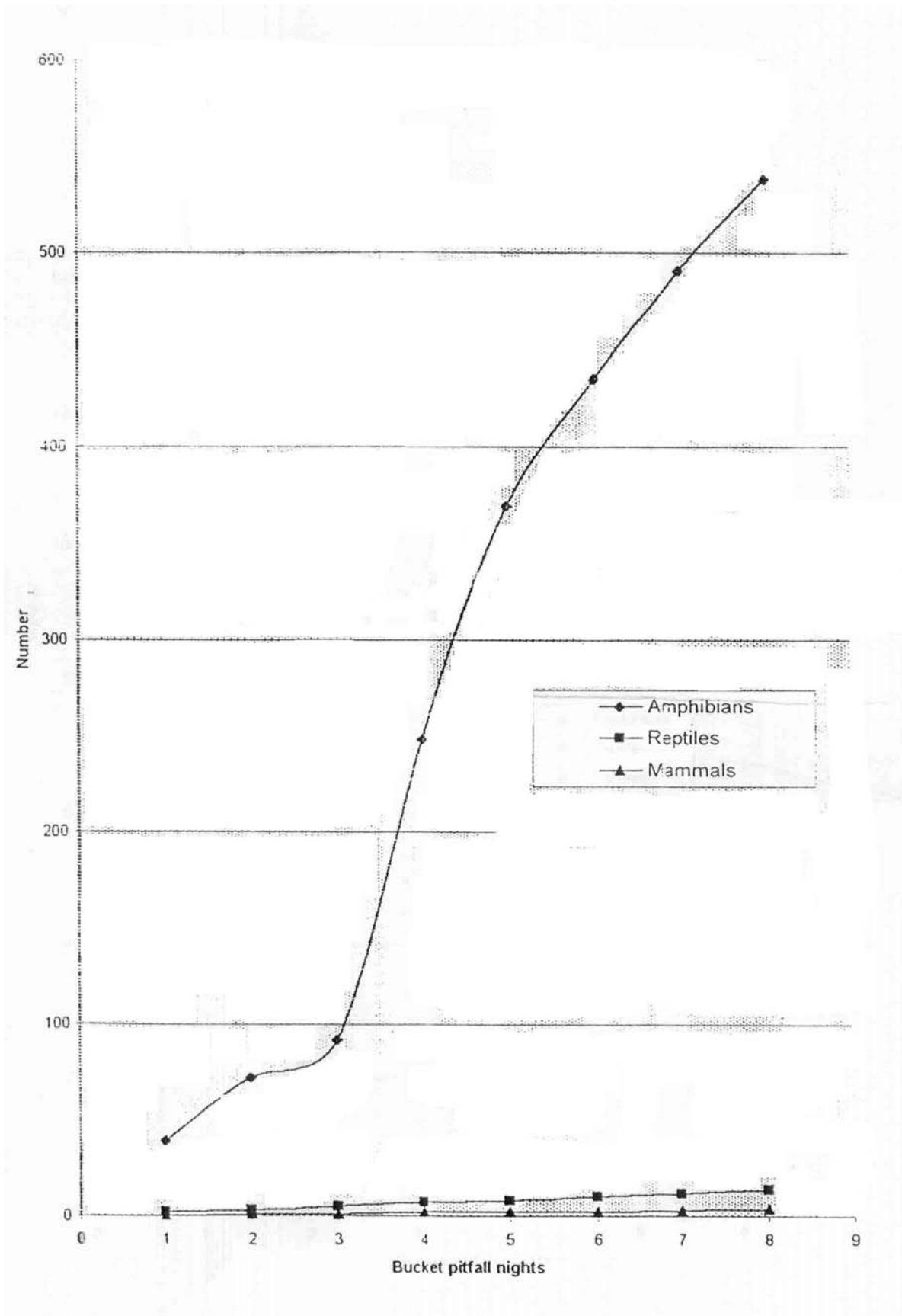


Figure 5: Cumulative Number of Species trapped by BPFs, Weme Site, February 2000

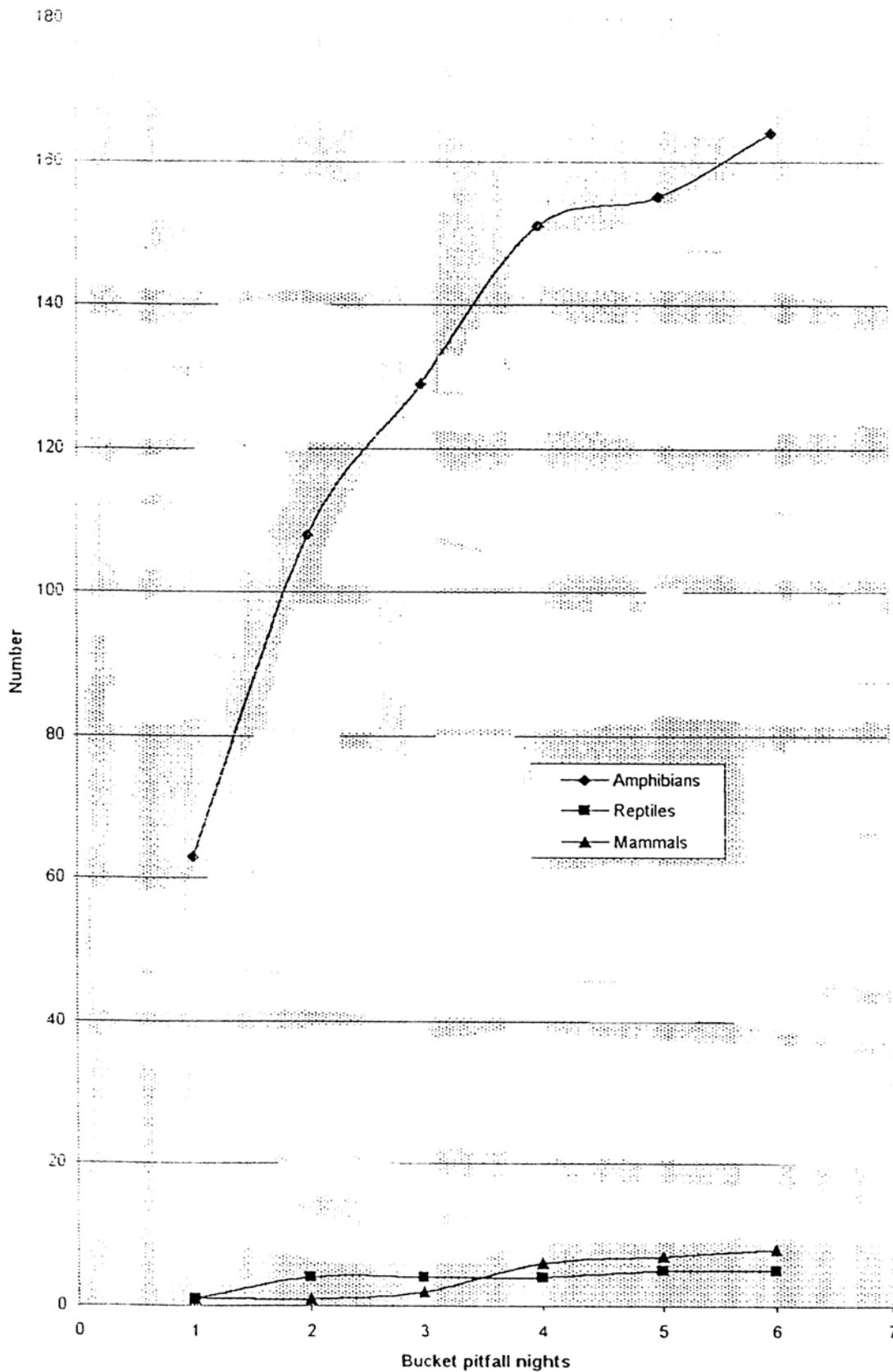


Figure 6: Cumulative Number of Species trapped by BPFLs, Kichi Site, February 2000

5.2 Weme and Kichi in comparison to nearby coastal forests

Two other forests in or adjacent to Rufiji District (the exact position of the boundary of one relative to that of the District remains problematical), Namakutwa and Kiwengoma Forest Reserves, have been sampled previously by Frontier-Tanzania (see Figure 2; Namakutwa is indicated on this map, Kiwengoma is not labeled but is at the southernmost portion).

These two forests have been sampled by Frontier-Tanzania, Kiwengoma in much more depth than Namakutwa, both with much more intensity than either Weme or Kichi. This is especially true for those species such as some lizards, snakes and frogs which are not readily sampled using pitfalls or snap traps. Bats were also sampled. The areas are not strictly comparable in size or elevation. Possibly the vegetation survey conducted as part of the REMP survey will provide more precise information as to the exact distribution of the different vegetation types, especially forest, at Weme and Kichi.

It is therefore, unfortunately not possible to make direct comparisons among these forests. However, it is useful to note the following considering these other forested areas.

Kiwengoma forest ranges in elevation from 250-740 m asl. Although the “Kiwengoma block” of forest covers about 76 sq km (in 1992), only about 33 sq km of forest are located within the boundary of the Kiwengoma Forest Reserve. For a discussion of its exact position and status, see Clarke & Dickinson (1995).

Frontier-Tanzania conducted biodiversity surveys in the Kiwengoma area for about 8 months, beginning in 1990. Mammal species of Conservation Concern found at Kiwengoma include Elephant, Leopard, Black and Red Elephant Shrew and Zanzibar Galago.

It has a rich reptile fauna, mostly of small, lesser-known species endemic to coastal and other forests (Broadley & Howell , in press). It is one of the three localities from which the coastal forest endemic *Lygodactylus broadleyi* is known. The two coastal forest toads, *Mertensophryne micranotis* and *Stephopaedes loveridgei* are both present.

Namakutwa Forest Reserve is about 46 sq km in area, and ranges in elevation from about 150 – 380 m asl. A general biodiversity survey of this area carried out by Frontier-Tanzania in 1992 appears to be the only one of its kind in Namakutwa. Among mammals, Elephant, Leopard and Zanzibar Galago were all noted, as was *Beamys hindei*, the Lesser pouched rat. Reptiles of interest include *Lygodactylus viscatus*, an overlooked day gecko of the coastal forests, as well as an amphisbaenian, the Liwale Round-snouted Amphisbaenian, *Loveridgeia ionidesi*. Amphibians appear to have been inadequately sampled, possibly because of unsuitable weather.

As noted above, it is not possible to compare the findings of Frontier-Tanzania, with many hundreds of person hours devoted to both trapping and collecting by hand, to the brief surveys conducted at Weme and Kichi. However, it is likely that many of the species found at these other two sites, especially the more widespread reptiles, are also found in the Weme and Kichi areas.

6 Threats to Biodiversity

6.1 Unsustainable use of the habitat with resultant change in forest quality and quantitative

Burgess & Muir (1994) listed threats to coastal forests. Among their list, conversion of forest to agriculture appears to be among the most important. Other threats include logging, (pitsawing), pole collection, fuel-wood gathering, charcoal burning and hunting. Most of these have become unsustainable. A further factor listed was the diminishing control by government services and local people. The only study which appears to have examined the effects of pole cutting in Tanzanian coastal forests is that of Hall & Rodgers (1986), who found that in easily accessible areas cutting intensities reached 50% of available poles. In the long term, the canopy will change in species composition, diversity, structure and perhaps even in continuity. Hopefully such intense pressure has not yet been generated in the Rufiji, but it is important to establish baseline data now with which to assess the effects of management techniques and alternatives whether or not these are part of the immediate REMP project, or future efforts.

6.2 Poaching

During our brief visit it was not possible to assess these and/or other threats. We have repeatedly found that local communities make use of a wide variety of forms of “bush meat” associated with the forests. The species trapped may range in size from small rodents to larger rodents (*Cricetomys gambianus*, the African Giant Rat) and Cane Rats (*Thryonomys* spp.). In Kenya, FitzGibbon, Mogaka, & Fanshawe, (1995) found that the Four-toed Elephant Shrew *Petrodromus tetradactylus* was regularly trapped for food.

In almost any forest bordering settlement, it is common to find wire or string snares set for bushpigs (in areas where pig flesh is not eaten, these animals are killed as agricultural pests), duikers and other antelopes. Hyrax are also taken in such snares. Larger herbivores such as buffalo and even hippopotamus may be poached for meat and/or the tusks. Despite the ban on trade in ivory, Elephants are still poached.

The effects of poaching on small isolated populations such as those found in the coastal forests will be greater than on larger and less fragmented populations. If animals are using the forests as a seasonal refuge, especially in the wet season, then they may be especially vulnerable to poaching, since their routes to and from the forest will be known, and they may be more concentrated in the forest than at other times of the year

6.3 Live animal trade

Currently Tanzanian government policy encourages the export of live birds and reptiles for the international market. It has in the past been recommended (Howell, in litt.) that such trade be limited to widely distributed species, and preferably those found on open land or in game reserves, not those which are forest dependent. Forest Division has little control knowledge and experience in managing wildlife and specifically, monitoring the collecting of live plants and animals. (Note: in Tanzania, it is Wildlife Division which manages issues relating to CITES, (the Convention on the International Trade in Wild Fauna and Flora). The collecting of live animals (and plants) should be prohibited in coastal forests because of their high levels of endemism and the risks involved to already isolated and highly fragmented populations.

7 Recommendations

7.1 The Need for Surveys and Monitoring

Preliminary indications are that both Weme and Kichi sites are of high biodiversity interest and importance. However, surveys have been made only for a short time and during one season. It is recommended that similar surveys be conducted at the beginning of the rains. This would maximize amphibian detection and probably result in an increase of mammal captures as well.

Namakutwa should be included in the sites to be sampled. Since baseline data already exist, this would be in effect a form of monitoring. The un-named wetland site also needs to be surveyed so that its importance can be assessed.

7.2 What types of surveys and monitoring are needed?

There will be a continuing need for survey and monitoring by specialist biologists. The main limiting factor involved is cost and occasionally, the availability of suitable personnel.

While it is important to have surveys and continued monitoring conducted by specialists, consideration should also be given to using the existing local expertise in conducting different types of surveys. Some of these might be visual, for example, for primates. Others might record types of large mammals seen. Obviously considerable local knowledge exists on the movement of larger mammals into and out of the two sites.

Human activity, such as the use of medicinal plants, or the cutting of poles, also needs to be monitored; without the continued existence of suitable habitat, the forest dependent species will eventually be lost in these forest patches.

In our experience, the use of local surveyors and monitors can be effective (for example, the on-going monitoring in the East Usambara forests) but requires the presence of a more highly trained—and highly motivated- individual to both supervise and encourage the local monitors.

Unfortunately, no easily recognizable “keystone” species has been identified for any coastal forest which might serve as an indicator for over-all ecosystem quality.—and an indication of biodiversity conservation. This is not surprising (see discussion of this issue in Introduction), but it does make the choice of which groups to monitor more difficult. It may be necessary to monitor certain endemics or forest dependent species with the assumption that major changes in the forest quality and quantity will affect these. Monitoring on a regular basis would at least permit the detection of change. For example, if monitoring indicated that a species suddenly was absent or only present in greatly reduced numbers, or if a species which was regarded as typical of woodland or agricultural land suddenly appeared deep inside a forest in large numbers one would at least be aware of a change.

Given the pressures on the sites in the study areas, it is likely that any monitoring efforts would need to be incorporated into sustainable use management efforts, or the setting up of alternative uses of particular parcels of land or other habitat—unless it were decided that total protection would be a management goal and strategy. . Detailed monitoring plans could only be developed after these options have been studied and finalized. This is especially so because many of the forests are so small that it is difficult to develop “internal buffer zones” (Rodgers, 1996).

An advantage which has perhaps been overlooked as regards monitoring by members of the local communities is that it helps to raise awareness of the value of species and habitats. If this awareness can be integrated into conservation and management efforts, then the likelihood of biodiversity conservation is higher than otherwise might be the case.

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9 Appendices

9.1 Appendix 1: Invertebrates

9.1.1 Appendix 1a. Terrestrial Molluscs

Verdcourt (1983) provided a now out-of-date list of East Africa species. This indicated a total of about 417 terrestrial species from Tanzania. Once it appears later this year (Verdcourt, in press, 2000) a list of snails and slugs for the coastal forests of eastern Africa will be available.

Due to the relatively dry conditions during the sampling period, terrestrial molluscs (“land snails” and slugs) were not adequately sampled. While casual collecting of these groups can yield useful information, intensive quantitative sampling such as that carried out elsewhere in eastern Africa requires considerable person power and is extremely time consuming (see Seddon, Tattersfield & Ruparelia, 1996). The most recent collecting by terrestrial mollusc specialists in coastal forests did not include those of the REMP study area. However, some idea of the intensity of sampling effort involved in sampling terrestrial molluscs is indicated by the hours required to sample an estimated 90% of the total species in an area. In the Eastern Arc forests, this varied from 12-18 to up to 29.8 hours.(Tattersfield, 1997).

Verdcourt (1990) reported on a collection of terrestrial snails made by Frontier-Tanzania from the Matumbi Hills, including the following:

- *Gulella matumbiensis* (described as new)
- *Maizania wahlbergi* a widespread species from Kenya to Natal;
- *Tropidophora (Otopoma) calcarea*
- *Rhachistia picturata*, a widespread lowland species
- *Rhachidina braunsi*, a widespread lowland species
- *Ceras matumbianum* described from the Kipatimu and Matumbi area generally
- *Pseudoglessula obtuse*, common in the area
- *P. sp. Nov?* near *P. introversa*;
- *P. sp. Nov*;
- *Opeas sp.*
- *Curvella sp. Nov.*
- *Curvella sp. Nov.*
- *C. sp. Nov ((possibly new)*
- *Achatina fulica*
- *Achatina grandidieriana*
- *Trachycystis ariel*, a widespread species
- *Sitala jenynsi* widespread coastal lowland species

At least three species of Urocyclid slugs including

- *Elisolimax sp.*
- *Trochozonites sp. Nov.*
- *Trochonanina sp. Nov.*
- *T. “smithi”*
- *Thapsia sp.*
- *T. sp.*
- *Tayloria helicoids*
- *Gonaxis denticulatus*
- *Gonaxis gibbosa*
- *Edentulina ovoidea*
- *Gulella planidens.*

Tattersfield (1997) noted that 71 species of terrestrial molluscs were recorded in coastal forest in 1995; 29 of these (16%) are common to both Eastern Arc and coastal forests (this figure may be higher but a

number of specimens identified only to “morphospecies” level were not included). Those species which are found in both the Eastern Arc and coastal forests include:

- *Achatina grandidieriana*
- *Cyathopoma azaniense*
- *Euonyma magilensis*
- *Gonaxis craveni*
- *Gulella gwendolinae*
- *Maizania cf volkensi*
- *Nesopupa cf bisulcata*
- *Opeas crenatum*
- *Curvella caloraphe*
- *Edentulina cf ovoidea*
- *Gonaxis cf denticulatus*
- *Nesopupa cf peilei*
- *Pupisoma cf orcula*
- *Subulina intermedia*
- *Subulona ordinarius*

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9.1.2 Appendix 1b. Mangrove associated molluscs and crustaceans (crabs)

Matthes & Kapetsky (1988) provide a world-wide list of mangrove associated aquatic species of invertebrates. Although not specifically based on Tanzanian species, those on their list recorded as occurring in geographical region 51, the Western Indian Ocean, would generally be expected to occur in the mangroves of the REMP area. It is likely that considerable taxonomic changes have occurred since the publication of their list, but as far as is known, it is the only one so far to have been compiled. Although many of the species included are indeed “aquatic”, some of these also are found associated with vegetation and/or abiotic substrates of the mangrove ecosystem. Some have relatively strict limits as regards salinity, others are more tolerant and may be found further upriver. Species important in the shell trade are listed. The terminology used in Matthes & Kapetsky (1988) differs somewhat from the more recent lists given in Richmond (1997). See Table 1b.

Table 14: Mangrove-associated aquatic species of economic importance (Modified from Matthes & Kapetsky, 1988). Common names follow Abbott (1962).

Zones are defined as follows:

Zone I=Outer, seaward edge, including intertidal zone;

Zone II, Inland edges and higher ground (sandbars, islands, landward edge of shorelines facing the sea);

Zone III, Secondary channels;

Zone IV, Open bays, bottom usually firm;

Zone V, sand, silt and flats, open ground in the intertidal zone;

Zone VI, inland estuary or river channel, brackish to fresh water, mangrove forest replaced by other vegetation.

Classification	Genus/Species	Common Name	Zone	Notes
Mollusca: Gastropoda				
Buccinidae				
		Whelks		
	<i>Engina mendicaria</i>		I	on hard substrates and seagrass beds
Cassididae				
		Helmet Shells		
	<i>Casmaria erinaceus</i>		I,IV	in weedbeds, sand, coral rubble
	<i>C. rufa</i>		I,IV	on sand, weed, coral; shellcraft
	<i>Phalium glaucum</i>		I,IV	
Cerithiidae				
		Ceriths		
	<i>Many</i>		I-V,(VI)	abundant in mangrove ecosystem
				some important in shell trade
				some obligate in mangroves
Conidae				
		Cones, Cone Shells		
	<i>Conus acuminatus</i>		I,IV,V	on sand, mud, weeds, intertidal, subtidal
	<i>C. arenatus</i>		I,IV,V	in sand-silt, intertidal, subtidal
	<i>C. augur</i>		I,IV,V	in sand, rubble, weedbeds, near coral
	<i>C. balteatus</i>		I,IV,V	sand and weed beds to rocky bottom
	<i>C. betulinus</i>		I,IV,V	in soft sand-mud bottom
	<i>C. biliosus</i>		I,IV,V	on hard substrate and seagrass/rubble
	<i>C. capitaneus</i>		I,IV (V)	under cover(rock, coral) on hard to sand
				bottom
	<i>C. characteristicus</i>		I,IV,V	in sand
	<i>C. catus</i>		I,IV,V	under cover in rubble, weeds, hard
				substrate
	<i>C. distans</i>		I,IV	on hard substrate and seagrass/rubble
	<i>C. ebraeus</i>		I,IV (V)	on hard substrate and seagrass/rubble
	<i>C. emaciatus</i>		I,IV,V	on sand to mud and grass bottom
	<i>C. erythraensis</i>		I,IV,V	on sand mud and wed bottom
	<i>C. excavatus</i>		I,IV,V	on hard to soft (silt) and weedy bottom
	<i>C. figulinus</i>		I,III,IV,V	usually on weedy bottom or on wood
	<i>C. generalis</i>		I,IV (V)	on hard (rubble) to soft (weedy) sub-
				strates
	<i>C. leopardus</i>		I,IV	usually on sandy bottom subtidally;
				burrows
	<i>Conus lividus</i>		I,(II,III) IV,V	on hard to muddy substrate, in weeds, to shoreline

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

Table 14 cont.

Classification	Genus/Species	Common Name	Zone	Notes
Conidae		Cones, Cone Shells		
	<i>C. miles</i>		I,IV	on hard bottom, usually under cover
	<i>C. musicus</i>		I,IV	under cover on hard to sandy bottom and weeds
	<i>C. namocanus</i>		I,IV,V	on soft, grassy bottoms and on stakes
	<i>C. quercinus</i>		I,IV	usually subtidal on sandy,weedy bottom
	<i>C. rattus</i>		I,IV	under cover on hard bottom
	<i>C. sanguinolentus</i>		I,IV,V	often confused with <i>C. lividus</i>
	<i>C. suratensis</i>		I,IV (V)	buries in sand, mud
	<i>C. taeniatus</i>		I,IV,V	mainly on hard substrate
	<i>C. terminus</i>		I,IV	in sand, under cover, subtidally
	<i>C. tessulatus</i>		I,IV	buries mainly in sand bars
	<i>C. textile</i>		I,IV	under cover in sand
	<i>C. tinianus</i>		I,IV	subtidal in sand and mud
	<i>C. vexillum</i>		I,IV	under cover in sand, silt
	<i>C. virgo</i>		I,IV,V	in sand, mud and weeds
	<i>C. zeylanicus</i>		I,IV	buries in sand-bars near coral
Cymatiidae		Hairy Tritons		
	<i>Charonia tritonis</i>		IV	valuable shell in trade
	<i>Cymatium muricinum</i>		I,IV	coral, sand, seagrass
	<i>C. pileare</i>		I,IV (V)	coral, sand, seagrass, on rocks also
Cypraeidae		Cowries		
	<i>Cypraea annulus</i>		I,II (III), IV, V	cowries are important in the shell trade and are also used as food and bait for fish. on hard substrate (coral) and in mainly inter-tidal weeds
	<i>C. caurica</i>		I,III,IV,V	under rocks, coral, on hard to mud bottom
	<i>C. clandestina</i>		I,(III), IV,V	under rocks, coral, wood, on hard to sand bottom
	<i>C. diluculum</i>		I,III,IV,V	in corals, on roots and stakes
	<i>Cypraea erosa</i>		I,(II),III IV,V	under rock, coral, wood; on stakes; hard to sandy bottom
	<i>C. helvola</i>		I,IV (V)	under/on rock, coral, stakes and grasses
	<i>C. isabella</i>		I,IV,V	mainly in coral heads
	<i>C. lamarcki</i>		I,III,IV,V	under rock, coral, on roots, stakes, sand and mud
	<i>C. moneta</i>		I,II,IV,V	on hard substrates; intertidal
	<i>C. nebrites</i>		I,IV (V)	under rock, coral on sandy bottom
	<i>C. ocellata</i>		I,IV	under rock, coral on sandy bottom
	<i>C. onyx</i>		I,III,IV,V	several subspecies; on stakes, roots, rocks and in seagrass
	<i>C. tigris</i>		I,(III), IV,V	under coral, rock, and on sandy bottom and in seagrass
	<i>C. turdus</i>		I,III,IV,V	on/under rock, coral, stakes and weed on sandy-muddy bottom
Epitoniidae		Wentletraps		
	<i>a few genera; Epitonium</i>		I,IV (V)	world-wide distribution; in sand, mud; generally subtidal, associated with sea
				Anemones
Fissurellidae		Keyhole Limpets		
	<i>Diodora and Fissurella, etc.</i> a few genera world-	Keyhole Limpets	I,IV (V)	world-wide, On rocks, coral, shells, etc.
Haliotidae		Abalone		
	<i>Haliotis spp.</i>		I,IV	world-wide, in mangroves, on roots, rocks, etc.
Hydatinidae		Bubble Shells		
	<i>Hydatina albocincta</i>		I,IV	in weed beds
	<i>H. physis</i>		I,IV	in weed beds
	<i>H. vesicaria</i>		I,IV	in lagoon shallows

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

Table 14 cont.

Classification	Genus/Species	Common Name	Zone	Notes
Hydatinidae		Bubble Shells		
Littorinidae		Periwinkles		
	<i>Littorina scabra</i>		II,III (V)	on rocky substrate
	<i>Littorina undulata</i>		II,III	on rocky substrate
Marginellidae		Margin Shells		
	<i>Marginella eumorpha</i>		I,IV	sand, weed, rubble
Mitridae		Miter Shells		
	<i>Mitra mitra</i>		I,IV (V)	coral to muddy, sand bottom
	<i>Pterygia crenulata</i>		I,IV (V)	in sand, mud, coral rubble
	<i>Scrabicola casta</i>		I,IV,V	no information given
	<i>S. fissureta</i>		I,IV,V	on sandy mud flats
	<i>Vexillum vulpecula</i>		I,IV	near coral in sand, mud
Modulidae				
	<i>Modulus tectum</i>		no info	no information given
Muricidae		Murex Shells		
	<i>Chicoreus ramosus</i>		I,IV,V	shell trade; mainly on sandy substrate in seagrass, near coral, rock.
	<i>C. torrefactus</i>		I,IV (V)	in seagrass, calcalgae, sand, rock
	<i>Haustellum haustellum</i>		I,IV	on firm bottom
	<i>Murex scolopax</i>		I,IV	on firm sand, mud, etc.
Nassaridae				
	<i>Nassarius spp.</i>		I-V	world wide scavengers; some used as bait; some in shell trade
Naticidae		Natica Snails		
	<i>Natica chinensis</i>		I,IV,V	soft bottom
	<i>N. undulata</i>		I,V	soft bottom
	<i>Polinices lacteus</i>	Moon Snails	I,IV,V	shell trade; on sand
	<i>P. mamilla</i>		I,IV,V	shell trade; on sand
	<i>P. maurus</i>		IV,V	no information given
	<i>P. simiae</i>		I,IV,V	no information given
Neritidae		Nerite Snails		
	<i>Nerita albicilla</i>		I,IV	on hard substrates, including wood
	<i>N. communis</i>		IV	brackish water
	<i>N. polita</i>		(I),II,IV	on hard substrates, including wood
Olividae		Olive Snails		
	<i>Agaronia, Ancilla</i>			
	<i>Oliva, Olivancillaria,</i>			
	<i>Olivella spp.</i>			circumtropical, worldwide, about 50 spp. in mangroves on sand-silt bottom shell trade
Patellidae		True Limpets		
	<i>Patella granularis</i>		I,II,IV	on rock, pilings, roots
Phasianellidae		Pheasant Shells		
	<i>Phrasianella, Tricolia</i>		I (III), IV, V	mainly on sea grass
	<i>and a few other genera</i>			
Potamididae				(often included in Cerithiidae)
	<i>several genera,</i>		(I),II,III,	world-wide, a number of spp abundant in
	<i>Batillaria, Cerithidea,</i>		(IV), V, VI	mangrove ecosystem; some are obligate;
	<i>Telescopium, Terebralia</i>			some important in shell trade
	<i>Tympanotus,</i>			
	<i>Rhinocoryne</i>			
Pyramidellidae		Pyramid Shells		
	<i>several/many</i>		I,IV,V	world wide, often parasitic on other molluscs; possible pest in mariculture, ie, oysters

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

Table 14 cont.

Classification	Genus/Species	Common Name	Zone	Notes
Strombidae		True Conchs		
	<i>Strombus decorus</i>		I,IV,V	in/near seagrass
	<i>S. gibberulus</i>		I II(III)IV V	no information given,probably as above
Terebridae		Auger Shells		
	<i>Impages hectica</i>		I,II,(IV)	on beach slopes
	<i>Tenebra areolata</i>		I,IV	sand
	<i>T. crenulata</i>		I,IV	sand
	<i>T. dimidiata</i>		I,IV,V	sand
	<i>T. duplicata</i>		I,IV	sand
	<i>T. maculata</i>		I,V	in sand
	<i>T. subulata</i>		I,IV,V	sand flats
Thaididae		Rock Shells		
	<i>Thais tuberosa</i>		I,(III), IV	on rocks, mangrove roots, etc.
Tonnidae		Tun Shells		
	<i>Tonna canaliculata</i>		I,IV	in seagrass beds
	<i>T. galea</i>		I,IV	shell trade; in seagrass and on sand in deeper channels
Trochidae		Top Shells		
	<i>Clanculus pharaonius</i>		I	on hard substrate under rock, coral
Turbinellidae		Chank Shells		
	<i>Turbinella pyrum</i>		I,IV,V	no information given
Turbinidae		Turban Shells		
	<i>Turbo chrysostoma</i>		I,IV	in shallow bays, lagoons on rock, coral and seagrass
Turridae		Turrid Shells		
	<i>Turris babylonia</i>		I,IV	deeper channels, soft bottoms
Volutidae		Volutes		
	<i>Lyria delessertiana</i>		I,IV	shell trade
	<i>L. lyraeformis</i>		I,IV	shell trade
Mollusca, Bivalvia				
Anomyiidae				
	<i>Anomya ephippium</i>		I,III,IV (V)	attached to any hard substrate
Arcidae		Ark Shells		
	<i>Anadara antiquata</i>		I,III,IV,V	sand, mud, weed flats
Carditidae		Carditas		
	<i>Cardita variegata</i>		IV	no information given
Chamidae		Jewel Boxes		
	<i>several genera and spp;</i>		I,III,IV	world-wide, attach to hard substrate including mangrove roots; used in shell trade
	<i>Arcinella, Chama,</i>			
	<i>Pseudochama</i>			
Donacidae		Wedge Clams		
	<i>Donax scortum</i>		I,II,IV	on beach slopes
Ostreidae		Oysters		
	<i>Lopha cristagalli</i>		I,IV	on any hard substrate
Pectinidae		Scallops		
	<i>Chlamys pallium</i>		IV	on any hard substrate
Pholadidae		Shipworms		
	<i>Martesia spp.</i>		I,III,IV,V	wood borers which cause grrreat damage to vessels, pilings, etc.
	<i>Xylophaga sp.</i>		I,(III),IV	wood borers which cause damage
Pinnidae		Pen Shells		
	<i>Pinna bicolor</i>		I,IV,V	no information given
Psammobiidae		Sanguin Clams		
	<i>Asaphis spp.</i>		I,IV	no information

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

Table 14 cont.

Classification	Genus/Species	Common Name	Zone	Notes
Pteriidae		Wing Oysters		
	<i>Pteria penguin</i>		I,IV	on hard substrate, including wood
Tellinidae		Tellins		
	<i>Tellina virgata</i>		I,IV,V	soft substrate
Teredinidae		Shipworms		
	<i>several genera, Bankia`</i>		I,III,IV,V (VI)	Shipworms which cause serious damage to wooden vessels, pilings, etc.
	<i>Teredo spp.</i>		I,III,IV,V (VI)	Shipworms which cause serious damage to wood

9.1.3 Appendix 1b: Crabs

Crabs make up a conspicuous element of the mangrove and associated habitats. Unfortunately, identification of any but the largest and most conspicuous species is not easy for the non-specialists. Table below is based on the list of Matthes & Kapetsky (1988). The recent field guide to the shores of eastern Africa (Richmond, 1997) provides illustrations and lists many more species, but as far as is known no study has been conducted of their precise distributions and ecology in the Rufiji area.

Table 15: Crabs of the Rufiji (mangrove) areas, based on Matthes & Kapetsky

Classification	Common Name	Zone	Notes
CRUSTACEA			
Brachyura (Crabs)			
Grapsidae			
<i>Sesarma</i> spp.		(I),II,V	Some large one eaten
Various genera			Used as bait
<i>Metapograpsus</i> , etc.			
Ocypodidae	Ghost Crabs		
<i>Ocypoda</i> spp.		II	
<i>Uca</i> spp.	Fiddler Crabs	general	World-wide; burrowing mud crab
<i>Ocypoda</i> spp.			
Portunidae			
<i>Liocarcinus corrugatus</i>		I,IV	
<i>Portunus pelagicus</i>	Swimming Crab	I,IV (V)	
<i>Scylla serrata</i>	Mangrove crab	I,III,IV (V)	Also found outside of mangroves
Hermit Crabs (Anomura)			
COENOBITIDAE			
	Land Hermit Crabs		This family not listed in Matthes & Kapetsky but Richmond notes several species in mangroves.
<i>Birgus latro</i> , Coconut Crab			See text; known only from islands.
<i>Coenobita</i> spp.			Several species in mangroves
DIOGENIDAE			
<i>Clibanarius longitarsus</i>			None listed but Richmond notes several species for the East African region.
Paguridae			Richmond notes these are usually found in holes in the reef, contrary to Matthes & Kapetsky.

Notes on other Crustaceans:

1. The only Tanzanian species of crustacean to be included in the IUCN red data book is the Coconut or Robber Crab *Birgus latro* which is regarded as “at risk “ (IUCN, 1983). This is known from small islands off shore of mainland Tanzania but has not been recorded from the mainland itself.
2. Freshwater crabs, Family Potamonautidae, are known to occur in forest habitats as well as riverine areas. Their taxonomy is difficult because of extremely high morphological variation and they must be identified by using features of the gonopods (legs modified for transferring sperm to females) found in the males. They are known to occur in the REMP area but have not been collected or studied in detail. In mountain areas with fast-flowing streams, there is a phoretic association with the early life history stages of blackflies, *Simulium* spp, the insects which are involved in the transmission of river blindness, and some freshwater crabs (Williams, 1968). However, the Blackflies associated with the transmission of river blindness are usually found near fast-flowing mountain stream waters in Tanzania.

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3. Richmond, M. (ed.). 1997 A Guide to the Seashores of Eastern Africa and the Western Indian Ocean islands. Sida, Dept. for Research Cooperation SAREC.
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9.1.4 Appendix 1c: Butterflies

Carcasson (1964) published one of the first works on butterfly distribution and zoogeography of African butterflies but although he noted the existence of a coastal zone fauna, no specific locality data were given. Kielland (1990) lists species in Tanzania but records very few as strictly associated with coastal forest habitats. His list of coastal endemics is small (see Table 1c below) and his book does not indicate many species with distributions restricted to his coastal zone. Furthermore, he notes that his “Zone 8” includes the Rufiji Basin, which has received little attention from butterfly specialists and so has very few records. Jong & Congdon (1993) discuss butterfly relationships between the Eastern Arc forests.

With the publication of Kielland & Cordeiro (in press, 2000), species lists for various coastal forests will be available.

The REMP area includes a wide variety of habitats, including, but not only coastal forest, mangrove forest and woodland. While studies from nearby areas will provide clues to species found in the REMP area, no doubt there is much to be learned from studies which deal specifically with samples of the habitats found there.

Table 16: Butterflies Endemic to the Coastal Zone as defined by Kielland (1990).

9a=northern, 9b, southern coastal zone. Habitat key: F=evergreen forest. G=gardens, farms

Family	Genus	Species	Subspecies	Zone	Habitat
HESPERIIDAE	<i>Sarangesa</i>	<i>tricerata</i>	<i>compacta</i>	9a	W
LYCAENIDAE	<i>Pentila</i>	<i>rondo</i>		9b	F
NYMPHALIDAE	<i>Acraea</i>	<i>hoopisama</i>		9a	F
NYMPHALIDAE	<i>Bebearia</i>	<i>orientis</i>	<i>insularis</i>	9b	G,F
NYMPHALIDAE	<i>Charaxes</i>	<i>acuminatus</i>	<i>rondo</i>	9b	F
NYMPHALIDAE	<i>Charaxes</i>	<i>blanda</i>	<i>blanda</i>	9b	W?
NYMPHALIDAE	<i>Euphaedra</i>	<i>neophron</i>	<i>rydoni</i>	9b	F
NYMPHALIDAE	<i>Junonia</i>	<i>westermanni</i>	<i>splendens</i>	9a	F
NYMPHALIDAE	<i>Pseudathyma</i>	<i>lucretioides</i>	<i>rondo</i>	9a	F

9.1.5 Appendix 1d: Diplopoda

The Diplopoda or millipedes form an important but usually inconspicuous element of the macroinvertebrate fauna. Like other arthropods, identification is not easy and the features of the gonopods (modified sixth pair of legs of males) are required for confirmation. Many new species and even genera have been discovered in Tanzania over the past 30 years, especially from coastal and Eastern Arc forests. Biologically millipedes are a very old group and most forest species appear unable to withstand desiccation. Only two or three specialists are willing to devote their attentions to this difficult group and most of the material collected by Frontier-Tanzania remains unidentified pending family and generic revisions. Specimens are routinely deposited with either Dr. R. L. Hoffman, Virginia Museum of Natural History or the Dept. of Entomology, Zoological Museum, Copenhagen. Estimates of total number of species for Tanzania have risen from about 150 in 1970 to over 1000; many of these will require major taxonomic revisions of their families and genera before they can be formally named.

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4. Kielland, J. 1990 *Butterflies of Tanzania*. Hill House, Melbourne & London.
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9.2 Appendix 2: Vertebrates

Note: All of the vertebrate groups found in coastal forests will be fully documented in review articles in Burgess & Clarke (in press) due out before the end of the year.

9.2.1 Appendix 2.1 Amphibians

Amphibians have been collected from various coastal forests but the results have not yet been analysed and summarised (Poynton, in press). An earlier paper by Poynton (1991) covers a much wider area, with few records from the Rufiji area. It is thus difficult to draw up a definitive comparative table for the forests in the REMP area. Apparently no list exists for the amphibians of the Selous Game Reserve, the nearest wildlife protected area.

Table 17: Amphibians of the REMP area and surroundings.

(W=Weme, KH= Kichi Hills, KG=Kiwengoma, MC=Mchungu, NK=Namakutwa)

Classification	Genus	Species	Common name	REMP survey	KG,MC ,NK	Notes
Anura						
ARTHROLEPTIDAE	<i>Arthroleptis</i>	<i>stenodactylus</i>	Common Squeaker	W,KH	KG	Widespread
	<i>Schoutedenella</i>	<i>xenodactyloides</i>	Dwarf Squeaker		KG,NK	
BUFONIDAE	<i>Bufo</i>	<i>gutturalis</i>	Guttural Toad	W	KG,NK	Widespread
	<i>Bufo</i>	<i>lindneri</i>		W		
	<i>Bufo</i>	<i>maculatus</i>	Flat-backed Toad			
	<i>Bufo</i>	<i>taitanus</i>	Taita Dwarf Toad			
	<i>Mertensophryne</i>	<i>micranotis</i>		KH	KG	
	<i>Schismaderma</i>	<i>carens</i>	Red Toad			
	<i>Stephopaedes</i>	<i>loveridgei</i>	Loveridge's Earless Toad	KH	KG	Known only from forest
HEMISIDAE	<i>Hemisis</i>	<i>marmoratus</i>	Mottled Shovel-snouted Frog	W	KG	Widespread
HYPEROLIIDAE	<i>Afrixalus</i>	<i>brachycnemis</i>	Golden Leaf-folding Frog	W		Widespread
	<i>Afrixalus</i>	<i>crotalus</i>				
	<i>Afrixalus</i>	<i>fornasinii</i>	Fornasini's Leaf-folding Frog		MC	Widespread
	<i>Hyperolius</i>	<i>argus</i>	Argus Reed Frog			
	<i>Hyperolius</i>	<i>mariae</i>				Coastal
	<i>Hyperolius</i>	<i>marmoratus</i>				Widespread
	<i>Hyperolius</i>	<i>mitchelli</i>	Mitchell's Reed Frog		KG	
	<i>Hyperolius</i>	<i>nasutus</i>	Gunther's Sharp-nosed Reed Frog			Widespread
	<i>Hyperolius</i>	<i>parkeri</i>	Parker's Reed Frog			Widespread, coastal
	<i>Hyperolius</i>	<i>pusillus</i>	Translucent Reed Frog			Widespread
	<i>Hyperolius</i>	<i>tuberilinguis</i>	Tinker Reed Frog			Widespread
	<i>Hyperolius</i>	<i>viridiflavus</i>				Widespread
	<i>Kassina</i>	<i>maculata</i>	Red-Legged Kassina			Widespread
	<i>Kassina</i>	<i>senegalensis</i>	Bubbling Kassina		MC	Widespread
	<i>Leptopelis</i>	<i>argenteus</i>				Widespread, E. Tanzania
	<i>Leptopelis</i>	<i>flavomaculatus</i>	Yellow-spotted Tree Frog		KG	Widespread, forest

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

Table 17 cont.

Classification	Genus	Species	Common name	REMP survey	KG,MC ,NK	Notes
MICROHYLIDAE	<i>Breviceps</i>	<i>mossambicus</i>	Mozambique Rain Frog	W,KH	KG,NK	Widespread
	<i>Phrynomantis</i>	<i>bifasciatus</i>	Red-banded Frog			Widespread
	<i>Spelaeophryne</i>	<i>methneri</i>	Scarlet-snouted Black Frog			Nearest locality Nangoma
PIPIDAE	<i>Xenopus</i>	<i>muelleri</i>	Muller's Clawed Frog			Widespread
RANIDAE	<i>Hildebrandtia</i>	<i>ornata</i>	Hildebrandt's Burrowing Frog	W		Widespread
	<i>Hylarana</i>	<i>galamensis</i>	Golden-backed Frog			Widespread
	<i>Phrynobatrachus</i>	<i>acridoides</i>	East African Puddle Frog	W		Widespread
	<i>Phrynobatrachus</i>	<i>mababiensis</i>	Common Puddle Frog	W		Widespread
	<i>Phrynobatrachus</i>	<i>natalensis</i>	Snoring Puddle Frog			Widespread
	<i>Ptychadena</i>	<i>anchietae</i>	Savanna Ridged Frog			Widespread
	<i>Ptychadena</i>	<i>mascareniensis</i>	Mascarene Ridged Frog	W		Widespread
	<i>Ptychadena</i>	<i>mossambica</i>	Broad-banded Ridged Frog			Widespread
	<i>Ptychadena</i>	<i>oxyrhynchus</i>	Sharp-nosed Ridged Frog			Widespread
	<i>Pyxicephalus</i>	<i>edulis</i>	African Bull Frog			Widespread along coast
	<i>Rana</i>	<i>angolensis</i>	Dusky-throated Rana			Widespread
RHACOPHORIDAE	<i>Chiromantis</i>	<i>xerampelina</i>	Grey Foam-nest Tree Frog	KH	NK	Widespread
Gymnophiona						
CAECILIIDAE	<i>Schistometopum</i>	<i>gregorii</i>	Mud-dwelling Caecilian	?		Probably occurs since known from mud at edge of Ngatana, Wami and Rufiji rivers.

9.2.2 Appendix 2.2 Reptiles

Broadley & Howell (in press) have summarised findings from a number of coastal forests and these are presented in Table 2.2. It is highly probable that many more species of reptiles are present at Weme and Kichi than were indicated by the brief sampling in only one season. Records from an unpublished list of reptiles of the Selous Game Reserve prepared by *C. Ionides* have been included for comparison.

Table 18: Reptiles

WE=Weme, KH= Kichi Hills, SGR=Selous Game Reserve (unpublished list); MK= Mchungu/Kikale Forest ; KG=Kiwengoma; TO=Tong'omba; NK=Namakutwa

Classification	WE	KH	SGR	MK	KG	TO	NK
Squamata, Sauria							
GEKKONIDAE							
<i>Lygodactylus broadleyi</i>				*			
<i>L. viscatus</i>					*	*	*
<i>L. capensis grotei</i>			*		*		
<i>L. luteopicturatus</i>			*		*		
<i>Cnemaspis uzungwae</i>		*			*	*	
<i>Hemidactylus mabouia</i>				*			*
<i>H. platycephalus</i>						*	*
<i>Pachydactylus turneri</i>			*				
AGAMIDAE							
<i>Agama atricollis</i>			*				
<i>Agama mossambica</i>			*		*	*	*
CHAMAELEONIDAE							
<i>Chamaeleo dilepis</i>		*	*		*		*
<i>C. melleri</i>			*		*		
<i>Rhampholeon brevicaudatus</i>					*	*	
<i>R. brachyurus</i>			*		*		
SCINCIDAE: SCINCINAE							
<i>Sepsina tetradactyla</i>	*	*	*		*		
<i>Melanoseps loveridgei</i>					*		
SCINCIDAE: LYGOSOMATINAE							
<i>Lygosoma afrum</i>			*				*
<i>Mabuya boulengeri</i>			*		*		*
<i>Mabuya maculilabris</i>	*						*
<i>Mabuya megalura</i>	*						
<i>Mabuya planifrons</i>			*				
<i>Mabuya quinquetaeniata</i>			*				
<i>Mabuya striata</i>	*		*		*		
<i>Mabuya varia</i>			*				
<i>Panaspis wahlbergi</i>	*		*		*	*	
LACERTIDAE							
<i>Gastropholis vittatus</i>			*				
<i>Holaspis guentheri</i>			*				*
<i>Ichnotropis squamulosa</i>			*				
<i>Latastia johnstoni</i>			*				
<i>Nucras boulengeri</i>			*				

Table 18 cont.

Classification	WE	KH	SGR	MK	KG	TO	NK
CORDYLIDAE							
<i>Cordylus tropidosternum</i>		*	*		*		
GERRHOSAURIDAE							
<i>Gerrhosaurus major</i>		*	*				
<i>G. flavigularis</i>							
<i>G. nigrolineatus</i>			*				
VARANIDAE							
<i>Varanus niloticus</i>			*				
<i>Varanus albigularis</i>			*				
Amphisbaenia							
AMPHISBAENIDAE							
<i>Loveridgea ionidesi</i>			*				*
Serpentes							
TYPHLOPIDAE							
<i>Rhinotyphlops schlegelii</i>	-				*		
<i>Typhlops rondoensis</i>			*				
LEPTOTYPHLOPIDAE							
<i>Leptotyphlops longicaudus</i>			*				
<i>Leptotyphlops macrops</i>				*			
<i>L. scutifrons</i>					*		
BOIDAE							
<i>Python natalensis</i>			*				
VIPERIDAE							
<i>Causus defilippii</i>		*	*			*	
<i>Bitis arietans</i>			*				*
<i>Bitis gabonica</i>		*					*
ATRACTASPIDIDAE							
<i>Atractaspis bibronii</i>			*		*		*
<i>Ambylodipsas katangensis</i>			*				
<i>Aparallactus capensis</i>			*				
<i>Aparallactus guentheri</i>			*				
<i>Aparallactus lunulatus</i>							
<i>Aparallactus werneri</i>			*		*		
<i>Chilorhinophis butleri</i>			*				
ELAPIDAE							
<i>Dendroaspis angusticeps</i>			*				
<i>Dendroaspis polylepis</i>			*				
<i>Elapsoidea semiannulata</i>			*				
<i>Naja melanoleuca</i>			*		*		
<i>N. mossambica</i>						*	*
<i>Naja nigricollis</i>			*				
COLUBRIDAE:							
LAMPROPHIINAE							
<i>Lamprophis fuliginosus</i>			*		*	*	
<i>Lycophidion capense</i>			*		*		
<i>Mehelya carpensis</i>			*				
<i>Mehelya nyassae</i>			*				
PSAMMOPHIINAE							
<i>Hemirhagerrhis nototaenia</i>			*	*			
<i>Psammophis angolensis</i>			*				
<i>P. phillipsii</i>			*				*

Table 18 cont.

Classification	WE	KH	SGR	MK	KG	TO	NK
PSAMMOPHIINAE							
<i>Psammophis subtaeniatus</i>			*		*	*	
<i>Psammophylax tritaeniatus</i>			*				
<i>Rhamphiophis rostratus</i>			*				
NATRICINAE							
<i>Natriciteres olivacea</i>			*		*	*	
COLUBRINAE							
<i>Meizodon semiornatus</i>			*				
<i>Prosymna stuhlmanni</i>			*				
<i>Philothamnus macrops</i>					*		
<i>P. hoplogaster</i>			*		*	*	
<i>P. punctatus</i>							
DISPHOLIDINI							
<i>Dispholidus typus</i>			*				
<i>Thelotornis capensis</i>			*		*	*	*
BOIGINI							
<i>Crotaphopeltis hotomboeia</i>	*		*		*		
<i>C. tornieri</i>					*		
<i>Dipsadoboa flavida</i> <i>broadleyi</i>			*				
<i>Telescopus semiannulatus</i>			*				
DASYPELTINI							
<i>Dasypeltis scabra</i>			*				
<i>D. medici</i>			*				

9.2.3 Appendix 2.3 Birds

Records of bird distributions by species on a quarter-degree scale exist for much of Tanzania but have not yet been published (Baker & Baker, Tanzania Bird Atlas, in prep.).

Three broad habitat types are found within the REMP project, wetlands, woodlands of various types, and closed forest.

Haldane (1946) lists birds for the Rufiji District; his list mainly deals with birds in the Utete area, but also covers more natural sites, and he includes species reported by other long-term residents of the area. It was prepared without the benefit of mist nets, and clearly has not included many of the smaller, more cryptic species, especially those of the undergrowth. A few of his records which were ambiguous or doubtful have been omitted.

The potential importance of the Rufiji delta and surrounding area to Palaearctic waders and other migrant birds has been recognised and the Danish ICBP funded an expedition to conduct shorebird counts from a boat but a copy of that report is not available at the time of writing.

Frontier-Tanzania has not focussed on birds in its inventory programme and even when birds have been examined, surveys only took place over a relatively short time and little if any intensive mist-netting was conducted.

However, birds have received detailed attention in some coastal forests, for example, Pugu (Howell, 1981; Baker & Baker, unpublished), nearby Kazimzumbwi forest (Mlingwa, Huxham & Burgess, 1993) and others to the north of the Rufiji river. Forest bird studies to the south have often focussed on the Rondo area. See Faldborg et al. 1991, Bhatia, 1993 and Burgess & Mlingwa, 1993 for summary data and some attention has been paid to coastal forest birds as compared to the bird faunas of other forests, especially those of the Eastern Arc (Stuart, 1981).

Table 19: Birds of the Rufiji Area as recorded by Haldane (1946).

X = recorded personally by Haldane, B= recorded by others and reported to him.

For comparative purposes, species with an asterisk* are those recorded for Zaraninge Forest (Z) and /or Kiwengoma Forest (K) by Burgess et. al, (1991).

RUFJI BIRDS						
Classification	Genus	Species	Common Name	Haldane	Notes	
ACCIPITRIDAE	<i>Accipiter</i>	<i>badius</i>	Shikra	X		
	<i>Accipiter</i>	<i>melanoleucus</i>	*Great Sparrowhawk	B	Z,K	
	<i>Accipiter</i>	<i>tachiro</i>	*African Goshawk	X	Z,K	
	<i>Aquila</i>	<i>rapax</i>	Tawny Eagle	B		
	<i>Aquila</i>	<i>wahlbergi</i>	Wahlberg's Eagle	X		
	<i>Circaetus</i>	<i>cinereus</i>	Brown Snake Eagle	X		
	<i>Circaetus</i>	<i>fasciolatus</i>	*Southern Banded Snake Eagle	X	Z,K	
	<i>Circaetus</i>	<i>pectoralis</i>	Black-chested Snake Eagle	X		
	<i>Elanus</i>	<i>caeruleus</i>	Black-shouldered Kite	X		
	<i>Gypohierax</i>	<i>angolensis</i>	Palm-nut Vulture	X		
	<i>Haliaeetus</i>	<i>vocifer</i>	Fish Eagle	X		
	<i>Kaupifalco</i>	<i>monogrammicus</i>	Lizard Buzzard	X		
	<i>Lophaetus</i>	<i>occipitalis</i>	Long-crested Eagle	B		
		<i>Macheiramphus</i>	<i>alcinus</i>	Bat Hawk		KMH: seen over Utete town
		<i>Micronisus</i>	<i>gabar</i>	Gabar Goshawk	X	
		<i>Milvus</i>	<i>migrans</i>	Black Kite	X	
	<i>Necrosyrtes</i>	<i>monachus</i>	Hooded Vulture	B		
	<i>Neophron</i>	<i>percnopterus</i>	Egyptian Vulture	B		
	<i>Polyboroides</i>	<i>radiatus</i>	Gymnogone	X		
	<i>Stephanoaetus</i>	<i>coronatus</i>	*Crowned Eagle		Z,K	

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

Table 19 continued

Classification	Genus	Species	Common Name	Haldane	Notes
ACCIPITRIDAE	<i>Terathopius</i>	<i>ECAUDATUS</i>	Bateleur	X	
	<i>Torgos</i>	<i>TRACHELIOTUS</i>	Lappet-faced Vulture	X	
	<i>Trigonoceps</i>	<i>OCCIPITALIS</i>	White-headed Vulture	X	
ALAUDIDAE	<i>Mirafra</i>	<i>RUFOCINNAMOMEA</i>	Flappet Lark	X	
ALCEDINIDAE	<i>Aldedo</i>	<i>QUADRIBRACHYS</i>	Shining Blue Kingfisher	B	
	<i>Ceryle</i>	<i>RUDIS</i>	Pied Kingfisher	X	
	<i>Ceyx</i>	<i>PICTA</i>	*Pygmy Kingfisher	X	Z,K
	<i>Corythornis</i>	<i>CRISTATA</i>	Malachite Kingfisher	X	
	<i>Halcyon</i>	<i>ALBIVENTRIS</i>	Brown-hooded Kingfisher	X	
	<i>Halcyon</i>	<i>CHELICUTI</i>	Striped Kingfisher	X	
	<i>Halcyon</i>	<i>SENEGALOIDES</i>	Mangrove Kingfisher	X	
	<i>Megaceryle</i>	<i>MAXIMA</i>	Giant Kingfisher	X	
ANATIDAE	<i>Alopochen</i>	<i>AEGYPTIACUS</i>	Egyptian Goose	X	
	<i>Dendrocygna</i>	<i>VIDUATA</i>	White-faced Whistling Duck	X	
	<i>Plectropterus</i>	<i>GAMBENSIS</i>	Spur-winged Goose	B	
	<i>Sarkidiornis</i>	<i>MELANOTOS</i>	Knob-billed Duck	X	
ANHINGIDAE	<i>Anhinga</i>	<i>RUFA</i>	African Darter	X	
APODIDAE	<i>Apus</i>	<i>AEQUATORIALIS</i>	Mottled Swift	B	
	<i>Apus</i>	<i>AFFINIS</i>	Little Swift	X	
	<i>Apus</i>	<i>APUS</i>	Eurasian Swift	B	
	<i>Apus</i>	<i>HORUS</i>	Horus Swift	X	
	<i>Cypsiurus</i>	<i>PARVUS</i>	Palm Swift	X	
ARDEIDAE	<i>Ardea</i>	<i>CINEREA</i>	Grey Heron	X	
	<i>Ardea</i>	<i>GOLIATH</i>	Goliath Heron	X	
	<i>Ardea</i>	<i>MELANOCEPHALA</i>	Black-headed Heron	X	
	<i>Ardea</i>	<i>PURPUREA</i>	Purple Heron	X	
	<i>Ardeola</i>	<i>RALLOIDES</i>	Squacco Heron	X	
	<i>Butorides</i>	<i>STRIATUS</i>	Green-backed Heron	X	
	<i>Egretta</i>	<i>ALBA</i>	Great White Egret	X	
	<i>Egretta</i>	<i>ARDESIACA</i>	Black Heron	X	
	<i>Egretta</i>	<i>GARZETTA</i>	Little Egret	X	
	<i>Ixobrychus</i>	<i>MINUTUS</i>	Little Bittern	X	
	<i>Mesophoyx</i>	<i>INTERMEDIA</i>	Yellow-billed Egret	X	
<i>Nycticorax</i>	<i>NYCTICORAX</i>	Black-crowned Night Heron	X		
BUCEROTIDAE	<i>Bucorvus</i>	<i>CAFER</i>	Southern Ground Hornbill	B	
	<i>Ceratogymna</i>	<i>BUCINATOR</i>	*Trumpeter Hornbill	X	Z,K
	<i>Tockus</i>	<i>ALBOTERMINATUS</i>	Crowned Hornbill	X	
	<i>Tockus</i>	<i>NASUTUS</i>	Grey Hornbill	X	
BURHINIDAE	<i>Burhinus</i>	<i>CAPENSIS</i>	Spotted Thicknee	B	
	<i>Burhinus</i>	<i>VERMICULATUS</i>	Water Thicknee	X	
CAMPEPHAGIDAE	<i>Campephaga</i>	<i>FLAVA</i>	Black Cuckoo Shrike	X	
	<i>Coracina</i>	<i>PECTORALIS</i>	White-breasted Cuckoo Shrike	X	
CAPITONIDAE	<i>Buccanodon</i>	<i>LEUCOTIS</i>	*White-eared Barbet		K
	<i>Lybius</i>	<i>MELANOPTERUS</i>	Brown-breasted Barbet	B	
	<i>Lybius</i>	<i>TORQUATUS</i>	Black-collared Barbet	X	
	<i>Pogoniulus</i>	<i>BILINEATUS</i>	*Yellow-rumped Tinkerbird	X	Z,K
	<i>Pogoniulus</i>	<i>SIMPLEX</i>	*Green Tinkerbird		Z
	<i>Trachyphonus</i>	<i>VAILLANTII</i>	Crested Barbet	X	
CAPRIMULGIDAE	<i>Caprimulgus</i>	<i>FOSSEI</i>	Gabon Nightjar	X	
	<i>Caprimulgus</i>	<i>PECTORALIS</i>	*Fiery-necked Nightjar		K
CHARADRIIDAE	<i>Charadrius</i>	<i>MARGINATUS</i>	White-fronted Plover	X	
	<i>Charadrius</i>	<i>PECUARIUS</i>	Kittlitz Plover	X	
	<i>Charadrius</i>	<i>TRICOLARIUS</i>	Three-banded Plover	X	
	<i>Vanellus</i>	<i>ALBICEPS</i>	White-crowned Plover	X	
	<i>Vanellus</i>	<i>CRASSIROSTRIS</i>	Long-toed Plover	B	
	<i>Vanellus</i>	<i>LUGUBRIS</i>	Senegal Plover	X	

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

Table 19 continued

Classification	Genus	Species	Common Name	Haldane	Notes
CHARADRIIDAE	<i>Vanellus</i>	<i>senegallus</i>	Wattled Plover	B	
CICONIIDAE	<i>Anastomus</i>	<i>lamelligerus</i>	Open-billed Stork	X	
	<i>Ciconia</i>	<i>ciconia</i>	White Stork	B	
	<i>Ciconia</i>	<i>episcopus</i>	Woolly-necked Stork	X	
	<i>Ephippiorhynchus</i>	<i>senegalensis</i>	Saddle-billed Stork	X	
	<i>Leptoptilos</i>	<i>crumeniferus</i>	Marabou Stork	B	
	<i>Mysteria</i>	<i>ibis</i>	Yellow-billed Stork	X	
COLIIDAE	<i>Colius</i>	<i>striatus</i>	Speckled Mousebird	X	
COLUMBIDAE	<i>Oena</i>	<i>capensis</i>	Namaqua Dove	X	
	<i>Streptopelia</i>	<i>capicola</i>	Ring-necked Dove	X	
	<i>Turtur</i>	<i>tympanistria</i>	*Tambourine Dove		Z,K
COLUMBIDAE	<i>Streptopelia</i>	<i>semitorquata</i>	Red-eyed Dove	X	
	<i>Treron</i>	<i>calva</i>	Green Pigeon	X	
	<i>Turtur</i>	<i> afer</i>	Blue-spotted Wood Dove	X	
	<i>Turtur</i>	<i>chalcospilos</i>	Emerald-spotted Wood Dove	X	
	<i>Turtur</i>	<i>tympanistria</i>	Tambourine Dove	X	
CORACIIDAE	<i>Coracias</i>	<i>caudata</i>	Lilac-breasted Roller	X	
	<i>Coracias</i>	<i>garrulus</i>	Eurasian Roller	X	
	<i>Coracias</i>	<i>spatulata</i>	Racket-tailed Roller	X	
	<i>Eurystomus</i>	<i>glacurus</i>	Broad-billed Roller	X	
CORVIDAE	<i>Corvus</i>	<i>albicollis</i>	White-necked Raven	B	
	<i>Corvus</i>	<i>albus</i>	Pied Crow	X	
CUCULIDAE	<i>Centropus</i>	<i>burchellii</i>	Burchell's Coucal	X	
	<i>Ceuthmochares</i>	<i>aereus</i>	*Yellowbill	X	K
	<i>Chrysococcyx</i>	<i>caprius</i>	Didric Cuckoo	B	
	<i>Chrysococcyx</i>	<i>cupreus</i>	Emerald Cuckoo	B	
	<i>Chrysococcyx</i>	<i>montanus</i>	*Barred Long-tailed Cuckoo		K
	<i>Clamator</i>	<i>glandarius</i>	Great Spotted Cuckoo	B	
	<i>Cuculus</i>	<i>canorus</i>	Common Cuckoo	B	
	<i>Cuculus</i>	<i>clamosus</i>	Black Cuckoo	B	
	<i>Cuculus</i>	<i>solitarius</i>	Red-chested Cuckoo	B	
	<i>Oxylophus</i>	<i>jacobinus</i>	Black & White Cuckoo	X	
DICRURIDAE	<i>Dicrurus</i>	<i>adsimilis</i>	Fork-tailed Drongo	X	
	<i>Dicrurus</i>	<i>ludwigii</i>	*Square-tailed Drongo	B	Z,K
ESTRILDIDAE	<i>Estrilda</i>	<i>astrild</i>	Common Waxbill	X	
	<i>Hypargos</i>	<i>niveoguttatus</i>	*Peters' Twinspot	X	Z,K
	<i>Lagonosticta</i>	<i>rhodopareia</i>	Jameson's Firefinch	X	
	<i>Lagonosticta</i>	<i>senegala</i>	Red-billed Firefinch	X	
	<i>Lonchura</i>	<i>bicolor</i>	Black & White Mannikin	X	
	<i>Lonchura</i>	<i>cucullata</i>	Bronze Mannikin	X	
	<i>Mandingoa</i>	<i>Nitidula</i>	*Green-backed Twinspot		Z,K
	<i>Uraeginthus</i>	<i>angolensis</i>	Southern Cordon bleu	X	
EURLAIMIDAE	<i>Smithornis</i>	<i>capensis</i>	*African Broadbill		Z,K
FALCONIDAE	<i>Falco</i>	<i>biarmicus</i>	Lanner Falcon	B	
	<i>Falco</i>	<i>chicquera</i>	Red-necked Falcon	X	
	<i>Falco</i>	<i>peregrinus</i>	Peregrine Falcon	B	
FRINGILLIDAE	<i>Emberiza</i>	<i>flaviventris</i>	Golden-breasted Bunting	X	
	<i>Serinus</i>	<i>mozambicus</i>	Yellow-fronted Canary	X	
GLAREOLIDAE	<i>Glareola</i>	<i>pratincola</i>	Collared Pranticole	B	
HELIORNITHIDAE	<i>Podica</i>	<i>senegalensis</i>	Finfoot	B	
HIRUNDINIDAE	<i>Hirundo</i>	<i>abyssinica</i>	Lesser Striped Swallow	X	
	<i>Hirundo</i>	<i>rustica</i>	Eurasian Swallow	X	
	<i>Hirundo</i>	<i>senegalensis</i>	Mosque Swallow	X	
	<i>Hirundo</i>	<i>smithii</i>	Wire-tailed Swallow	X	
	<i>Psalidoprocne</i>	<i>pristoptera</i>	*Black Rough-wing		
	<i>Riparia</i>	<i>paludicola</i>	African Sand Martin	X	

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

Table 19 continued

Classification	Genus	Species	Common Name	Haldane	Notes	
INDICATORIDAE	<i>Indicator</i>	<i>indicator</i>	Greater Honeyguide	X		
	<i>Indicator</i>	<i>variegatus</i>	*Scaly-throated Honeyguide		K	
JACANIDAE	<i>Actophilornis</i>	<i>africanus</i>	Jacana	X		
	<i>Microparra</i>	<i>capensis</i>	Lesser Jacana	B		
LANIIDAE	<i>Lanius</i>	<i>collurio</i>	Red-backed Shrike	x		
MALACONOTIDAE	<i>Dryoscopus</i>	<i>cubla</i>	*Black-backed Puffback	X		
	<i>Dryoscopus</i>	<i>gambensis</i>	Northern Puffback			
	<i>Dryoscopus</i>	<i>pringlii</i>	Pringle's Puffback			
	<i>Laniarius</i>	<i>aethiopicus</i>	*Tropical Boubou	X		
	<i>Malaconotus</i>	<i>blanchoti</i>	Grey-headed Bush Shrike	X		
	<i>Malaconotus</i>	<i>quadricolor</i>	*Four-coloured Bush Shrike	X		
	<i>Malaconotus</i>	<i>sulfureopectus</i>	Sulphur-breasted Bush Shrike	X		
	<i>Nilaus</i>	<i>affer</i>	Brubru	X		
	<i>Tchagra</i>	<i>australis</i>	Brown-crowned Tchagra	X		
	<i>Tchagra</i>	<i>minuta</i>	Marsh Tchagra	X		
	MALACONOTIDAE	<i>Dryoscopus</i>	<i>cubla</i>	*Black-backed Puffback		Z,K
		<i>Malaconotus</i>	<i>quadricolor</i>	*Four-colored Bush Shrike		Z,K
<i>Laniarius</i>		<i>ferrugineus</i>	*Tropical Boubou		Z,K	
<i>Tchagra</i>		<i>senegala</i>	Black-crowned Tchagra	X		
MEROPIDAE	<i>Merops</i>	<i>albicollis</i>	White-throated Bee-eater	X		
	<i>Merops</i>	<i>apiaster</i>	Eurasian Bee-eater	X		
	<i>Merops</i>	<i>boehmi</i>	Boehm's Bee-eater	X		
	<i>Merops</i>	<i>bullockoides</i>	White-fronted Bee-eater	X		
	<i>Merops</i>	<i>hirundineus</i>	Swallow-tailed Bee-eater	X		
	<i>Merops</i>	<i>nubicus</i>	Northern Carmine Bee-eater	X		
	<i>Merops</i>	<i>persicus</i>	Blue-cheeked Bee-eater	X		
	<i>Merops</i>	<i>pusillus</i>	Little Bee-eater	X		
	<i>Merops</i>	<i>superciliosus</i>	Madagascar Bee-eater	X		
MOTACILLIDAE	<i>Anthus</i>	<i>leucophrys</i>	Plain-backed Pipit	X		
	<i>Anthus</i>	<i>sokokensis</i>	*Sokoke Pipit		Z	
	<i>Motacilla</i>	<i>aguimp</i>	African Pied Wagtail	X		
MUSCICAPIDAE	<i>Batix</i>	<i>mixta</i>	*Forest Batis		Z	
	<i>Batis</i>	<i>molitor</i>	Chin-spot Batis	X		
	<i>Bias</i>	<i>musicus</i>	*Black & White Flycatcher	X	K	
	<i>Erythrocerus</i>	<i>holochlorus</i>	*Little Yellow Flycatcher		Z	
	<i>Melaenornis</i>	<i>pammelaina</i>	Southern Black Flycatcher	X		
	<i>Muscicapa</i>	<i>caerulescens</i>	Ashy Flycatcher	X		
	<i>Muscicapa</i>	<i>striata</i>	Spotted Flycatcher	B		
	<i>Platysteira</i>	<i>peltata</i>	Black-throated Wattle-eye	X		
	<i>Terpsiphone</i>	<i>viridis</i>	*Paradise Flycatcher	X	Z	
	<i>Trochocercus</i>	<i>cynomelas</i>	*Crested Flycatcher	X	Z,K	
MUSOPHAGIDAE	<i>Corythaixoides</i>	<i>concolor</i>	Grey Go-away Bird	X		
	<i>Tauraco</i>	<i>livingstonii</i>	*Livingstone's Turaco	B	Z,K	
	<i>Tauraco</i>	<i>porphyreolophus</i>	Purple-crested Turaco	X		
NECTARINIIDAE	<i>Anthreptes</i>	<i>collaris</i>	*Collared Sunbird	X		
	<i>Anthreptes</i>	<i>richnowii</i>	*Plain-backed Sunbird		Z	
	<i>Anthreptes</i>	<i>neglectus</i>	*Uluguru Violet-backed S'brd		Z,K	
	<i>Nectarinia</i>	<i>amethystina</i>	Amethyst Sunbird	X		
	<i>Nectarinia</i>	<i>olivacea</i>	*Olive Sunbird	B	Z,K	
	<i>Nectarinia</i>	<i>senegalensis</i>	Scarlet-chested Sunbird	X		
NUMIDIDAE	<i>Guttera</i>	<i>pucherani</i>	*Crested Guinea fowl	B	Z,K	
	<i>Numida</i>	<i>meleagris</i>	Helmeted Guinea fowl	X		
ORIOOLIDAE	<i>Oriolus</i>	<i>auratus</i>	African Golden Oriole	X		
	<i>Oriolus</i>	<i>larvatus</i>	Black-headed Oriole	X		
OTIDIDAE	<i>Eupodotis</i>	<i>melanogaster</i>	Black-bellied Bustard	X		
PANDIONIDAE	<i>Pandion</i>	<i>haliaetus</i>	Osprey	B		

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

Table 19 continued

Classification	Genus	Species	Common Name	Haldane	Notes
PELECANIDAE	<i>Pelecanus</i>	<i>onocrotalus</i>	Great White Pelican	B	
	<i>Pelecanus</i>	<i>rufescens</i>	Pink-backed Pelican	X	
PHALACROCORACIDAE	<i>Phalacrocorax</i>	<i>africanus</i>	Long-tailed Cormorant	X	
	<i>Phalacrocorax</i>	<i>lucidus</i>	White-breasted Cormorant	B	
PHASIANIDAE	<i>Coturnix</i>	<i>delegorguei</i>	Harlequin Quail	B	
	<i>Francolinus</i>	<i>afer</i>	Red-necked Spurfowl	X	
	<i>Francolinus</i>	<i>coqui</i>	Coqui Francolin	B	
	<i>Francolinus</i>	<i>hildebrandti</i>	Hilderbrandt's Francolin	X	
PHOENICULIDAE	<i>Phoeniculus</i>	<i>purpureus</i>	Green Wood Hoopoe	X	
	<i>Rhinopomastus</i>	<i>cynomelas</i>	Common Scimitarbill	X	
PICIDAE	<i>Campethera</i>	<i>abingoni</i>	*Golden-tailed Woodpecker	X	K
	<i>Campethera</i>	<i>cailliautii</i>	*Little-spotted Woodpecker		Z,K
	<i>Dendropicos</i>	<i>fuscescens</i>	Cardinal Woodpecker	X	
	<i>Dendropicus</i>	<i>namaquus</i>	Bearded Woodpecker	X	
PITTIDAE	<i>Pitta</i>	<i>angolensis</i>	*African Pitta	B	K
PLOCEIDAE	<i>Amyblospiza</i>	<i>albifrons</i>	Grosbeak Weaver	X	
	<i>Anaplectes</i>	<i>rubriceps</i>	Red-headed Weaver	X	
	<i>Euplectes</i>	<i>ardens</i>	Red-collared Widowbird	X	
	<i>Euplectes</i>	<i>axillaris</i>	Fan-tailed Widowbird	X	
	<i>Euplectes</i>	<i>capensis</i>	Yellow Bishop	X	
	<i>Euplectes</i>	<i>hordeaceus</i>	Black-winged Red Bishop	X	
	<i>Euplectes</i>	<i>nigroventris</i>	Zanzibar Red Bishop	X	
	<i>Passer</i>	<i>griseus</i>	Grey-headed Sparrow	X	
PLOCEIDAE	<i>Ploceus</i>	<i>bicolor</i>	*Dark-backed Weaver	X	Z,K
	<i>Ploceus</i>	<i>ocularis</i>	Spectacled Weaver	X	
	<i>Vidua</i>	<i>chalybeata</i>	Village Indigobird	X	
	<i>Vidua</i>	<i>macroura</i>	Pin-tailed Whydah	X	
	<i>Vidua</i>	<i>paradisaea</i>	Eastern Paradise Whydah	B	
PODICIPEDIDAE	<i>Tachybaptus</i>	<i>ruficollis</i>	Little Grebe	B	
PRIONOPIDAE	<i>Prionops</i>	<i>polioloophus</i>	Grey-crested Helmet Shrike	X	
	<i>Prionops</i>	<i>retzii</i>	Retz's Helmet Shrike	X	
	<i>Prionops</i>	<i>scopifrons</i>	*Chestnut-fronted Helmet Shrike	X	Z,K
PSITTACIDAE	<i>Agapornis</i>	<i>lilliane</i>	Lillian's Lovebird	B	
	<i>Poicephalus</i>	<i>cryptoxanthus</i>	*Brown-headed Parrot	X	K
	<i>Poicephalus</i>	<i>robustus</i>	*(Brown-necked Parrot	B	Z
PTEROCLIDAE	<i>Pterocles</i>	<i>Sp.</i>	Sandgrouse	B	
PYCNONOTIDAE	<i>Andropadus</i>	<i>importunus</i>	Sombre Greenbul	X	
	<i>Chlorocichla</i>	<i>flaviventris</i>	*Yellow-bellied Greenbul		Z,K
	<i>Nicator</i>	<i>chloris</i>	*Nicator	X	
	<i>Phyllastrephus</i>	<i>fischeri</i>	*Fischer's Greenbul		Z,K
	<i>Phyllastrephus</i>	<i>flavostriatus</i>	*Yellow-streaked Greenbul		Z,K
	<i>Phyllastrephus</i>	<i>debilis</i>	*Tiny Greenbul		Z,K
	<i>Pycnonotus</i>	<i>tricolor</i>	Dark-capped Bulbul	X	
RALLIDAE	<i>Amaurornis</i>	<i>flavirostra</i>	Black Crake	X	
	<i>Crex</i>	<i>crex</i>	Corncrake	B	
	<i>Gallinula</i>	<i>chloropus</i>	Common Moorhen	B	
	<i>Porphyrio</i>	<i>porphyrio</i>	Purple Gallinule	B	
	<i>Porzana</i>	<i>pusilla</i>	Baillon's Crake	B	
	<i>Rallus</i>	<i>caerulescens</i>	African Water Rail	B	
	<i>Sarothrura</i>	<i>elegans</i>	Buff-spotted Flufftail	B	
RECURVIROSTRIDAE	<i>Himantopus</i>	<i>himantopus</i>	Black-winged Stilt	B	
	<i>Recurvirostra</i>	<i>avosetta</i>	Avocet	B	
RHYNCHOPIDAE	<i>Rhynchops</i>	<i>flavirostris</i>	African Skimmer	X	
SALPORNITHIDAE	<i>Salpornis</i>	<i>spilonota</i>	Spotted Creeper	B	

Table 19 continued

Classification	Genus	Species	Common Name	Haldane	Notes
SCOLOPACIDAE	<i>Actitis</i>	<i>hypoleucos</i>	Common Sandpiper	X	
	<i>Arenaria</i>	<i>interpres</i>	Turnstone	B	
	<i>Calidris</i>	<i>ferruginea</i>	Curlew Sandpiper	B	
	<i>Calidris</i>	<i>minuta</i>	Little Stint	X	
	<i>Numenius</i>	<i>arquata</i>	Eurasian Curlew	X	
	<i>Numenius</i>	<i>phaeopus</i>	Whimbrel	B	
	<i>Tringa</i>	<i>nebularia</i>	Common Greenshank	X	
	<i>Tringa</i>	<i>ochropus</i>	Green Sandpiper	X	
	<i>Tringa</i>	<i>stagnatilis</i>	Marsh Sandpiper	X	
	SCOPIDAE	<i>Scopus</i>	<i>umbretta</i>	Hamerkop	X
STRIGIDAE	<i>Asio</i>	<i>capensis</i>	African Marsh Owl	B	
	<i>Bubo</i>	<i>lacteus</i>	Verreaux's Eagle Owl	B	
	<i>Ciccaba</i>	<i>woodfordii</i>	*African Wood Owl		Z,K
	<i>Scotopelia</i>	<i>pele</i>	Pel's Fishing Owl	X	
STURNIDAE	<i>Buphagus</i>	<i>erythrorhynchus</i>	Red-billed Oxpecker	B	
	<i>Cinnyricinclus</i>	<i>leucogaster</i>	Violet-backed Starling	X	
	<i>Lamprotornis</i>	<i>chloropterus</i>	Lesser Blue-eared Starling	X	
	<i>Lamprotornis</i>	<i>corruscus</i>	*Black Bellied Glossy Starling		Z,K
SYLVIIDAE	<i>Apalis</i>	<i>melanocephala</i>	*Black-headed Apalis		Z
	<i>Camaroptera</i>	<i>brevicaudata</i>	*Gray-backed Camaroptera	X	Z,K
	<i>Cisticola</i>	<i>galactotes</i>	Winding Cisticola	X	
	<i>Eremomela</i>	<i>icteropygialis</i>	Yellow-bellied Eremomela	X	
	<i>Eremomela</i>	<i>scotops</i>	Green-capped Eremomela	X	
	<i>Macrosphenus</i>	<i>kretschmeri</i>	*Kretschmer's Longbill		Z,K
	<i>Melocichla</i>	<i>mentalis</i>	African Moustached Warbler	X	
	<i>Prinia</i>	<i>subflava</i>	Tawny-flanked Prinia	X	
SYLVIIDAE	<i>Sylvietta</i>	<i>whytii</i>	Red-faced Crombec	X	
THRESKIORNITHIDAE	<i>Bostrychia</i>	<i>hagedash</i>	Hadada Ibis	X	
	<i>Platalea</i>	<i>alba</i>	African Spoonbill	X	
	<i>Plegadis</i>	<i>falcinellus</i>	Glossy Ibis	B	
	<i>Threskiornis</i>	<i>aethiopica</i>	Sacred Ibis	X	
TIMALIIDAE	<i>Turdoides</i>	<i>jardineii</i>	Arrow-marked Babbler	X	
TROGONIDAE	<i>Apaloderma</i>	<i>narina</i>	*Narina's Trogon	B	Z,K
TURDIDAE	<i>Cercotrichas</i>	<i>leucophrys</i>	White-browed Scrub Robin	X	
	<i>Cercotrichas</i>	<i>quadrivirgata</i>	*Eastern Bearded Scrub Robin		Z,K
	<i>Cichladusa</i>	<i>arquata</i>	Collared Palm Thrush	X	
	<i>Cossypha</i>	<i>heuglini</i>	White-browed Robin Chat	X	
	<i>Cossypha</i>	<i>natalensis</i>	*Red-capped Robin Chat		Z,K
	<i>Myrmecocichla</i>	<i>arnoti</i>	White-headed Black Chat	X	
	<i>Neocossyphus</i>	<i>rufus</i>	*Red-tailed Ant Thrush		Z,K
	<i>Turdus</i>	<i>gurneyi</i>	*Orange Ground Thrush		Z
	<i>Turdus</i>	<i>libonyanus</i>	Kurrichane Thrush	X	
TYTONIDAE	<i>Tyto</i>	<i>alba</i>	Barn Owl	X	
UPUPIDAE	<i>Upupa</i>	<i>africana</i>	African Hoopoe	X	
ZOSTEROPIDAE	<i>Zosterops</i>	<i>senegalensis</i>	*Yellow White-eye	X	

Burgess et. al. 1991 provide a table of forest species for coastal forests to the north of and south of the REMP area. Burgess & Mlingwa (1993) ranked coastal forests according to total species, a rarity score, etc. The following summarises some of these data.

Table 20: Bird assemblages and ornithological importance in Tanzanian coastal forests

Forest	Total species	Rarity score	Area (sq km)	Weeks of study
Tanga	16	6.0	1-2	1
Msumbugwe	46	4.5	15	1
Zaraninge	54	10.5	19-22	7
Pande	38	3.0	11	3
Pugu	54	13.5	10	52+
Kazimzumbwi	47	4.5	12	3
Vikindu	27	6.0	10	1
Kisiju	14	0.0	2	1
Mchungu	34	1.0	1-3	1
Kiwengoma	44	3.5	10-25	3
Litipo	35	6.5	10	2
Rondo	59	11.5	18-20	14

9.2.4 Appendix 2.4 Mammals

General

The REMP area is large and complex in its vegetational structure; it is also bordered by the Selous Game Reserve. Perhaps surprisingly, there has apparently been no published list of the Selous GR based on specimens collected over the years. The only checklist of mammals available for Tanzania, that of Swynnerton & Hayman (1951), unfortunately provides few records for Rufiji District. While hunting records and aerial surveys indicate what may be (or may have been) found in the REMP area for large, conspicuous species, we have no definitive list for the Selous Game Reserve. Apart from species of widespread distribution in woodland habitats, it is difficult to extrapolate from other areas nearby to those of REMP.

Burgess et al. (in press) summarise what is known about mammals of coastal forests. I have provided lists of species from sites which have been sampled to the north of and south of REMP, with the assumption that species found at such localities should also be found (or potentially could be found) within the REMP area.

Frontier-Tanzania has conducted trapping for small rodents and shrews using traditional snap traps as well as bucket pitfalls in many of the coastal forests. However, trapping effort has not always been constant among forests. Unfortunately, identifications for many species, especially shrews, are not yet available; the main problem is determining identifications to the species level. This requires the use of dental and skeletal characters, skulls, a collection of comparative material and highly motivated, interested specialists.

Elephant shrews: The large *Rhynchocyon* Elephant shrews of coastal forests were sampled by “Njule 1992”, but the results have not been published. As far as is known, the project area was not included (Hanna, 1992; Hanna & Anderson, 1994).

Bats: The only effective way to sample bats is by the use of mist nets. Cockle et al. (1998) describe bats from coastal forests. See Table 23 for summary information.

Table 21: Larger Mammals of the Rufiji area

IUCN 1996 refers to latest threat status; REMP survey, etc. indicates presence detected and/or indication using standard references such as Kingdon (1997) to comment on range of species. EAWLS refers to EAWLS (1976), an East African questionnaire and observation survey for larger species. “Widespread” indicates it is shown as such in EAWLS. C=CITES Appendix: SGR= unpublished list for Selous Game Reserve

ORDER	FAMILY	GENUS	SPECIES	IUCN 1996	C	REMP SURVEY,ETC	EAWLS SURVEY/SGR
ARTIODACTYLA	Bovidae	<i>Aepyceros</i>	<i>melampus</i>	CD		present	X
	Bovidae	<i>Cephalophus</i>	<i>monticola</i>		II	might occur	Mafia and near Dar
	Bovidae	<i>Cephalophus</i>	<i>natalensis</i>	CD		probably present	X
	Bovidae	<i>Connochaetes</i>	<i>taurinus</i>	CD		probably present	woodland in Selous
	Bovidae	<i>Hippotragus</i>	<i>niger</i>	CD		probably present	X
	Bovidae	<i>Kobus</i>	<i>defassa</i>	CD		probably present	X
	Bovidae	<i>Redunca</i>	<i>arundinum</i>	CD		apparently absent	not shown as present
	Bovidae	<i>Redunca</i>	<i>redunca</i>	CD		apparently absent	not shown as present
	Bovidae	<i>Sylvicapra</i>	<i>grimmia</i>			probably present	X
	Bovidae	<i>Syncerus</i>	<i>caffer</i>	CD		possibly still present	X
	Bovidae	<i>Taurotragus</i>	<i>oryx</i>	CD		probably in woodland	X
	Bovidae	<i>Tragelaphus</i>	<i>scriptus</i>			probably in woodland	X
	Bovidae	<i>Tragelaphus</i>	<i>strepsiceros</i>	CD		probably in woodland	X
	Hippopotamidae	<i>Hippopotamus</i>	<i>amphibius</i>		II	X	X
Suidae	<i>Phacochoerus</i>	<i>africanus</i>			X	X	
Suidae	<i>Potamochoerus</i>	<i>larvatus</i>			X	X	
CARNIVORA	Canidae	<i>Canis</i>	<i>adustus</i>				Widespread;SGR
	Canidae	<i>Lycaon</i>	<i>pictus</i>	EN			in general area

Technical Report 9: A Preliminary Biodiversity (fauna) Assessment of the Rufiji Floodplain and Delta

ORDER	FAMILY	GENUS	SPECIES	IUCN 1996	C	REMP SURVEY,ETC	EAWLS SURVEY/SGR
CARNIVORA	Canidae	<i>Otocyon</i>	<i>megalotis</i>				might occur
	Felidae	<i>Felis</i>	<i>caracal</i>		II		?
	Felidae	<i>Felis</i>	<i>serval</i>		II		SGR
	Felidae	<i>Felis</i>	<i>silvestris</i>		II	might occur	SGR
	Felidae	<i>Panthera</i>	<i>leo</i>	VU	II	in general area	no records but widespread
	Felidae	<i>Panthera</i>	<i>pardus</i>		I	in general area	no records but widespread
	Herpestidae	<i>Atilax</i>	<i>paludinosus</i>				Widespread; SGR
	Herpestidae	<i>Bdeogale</i>	<i>crassicauda</i>				Widespread; SGR
	Herpestidae	<i>Galerella</i>	<i>sanguinea</i>				Widespread; SGR
	Herpestidae	<i>Helogale</i>	<i>parvula</i>				Widespread; SGR
	Herpestidae	<i>Herpestes</i>	<i>ichneumon</i>				Widespread; SGS
	Herpestidae	<i>Ichneumia</i>	<i>albicauda</i>				Widespread; probably in SGR
	Herpestidae	<i>Mungos</i>	<i>mungo</i>				Widespread; SGR
	Herpestidae	<i>Rhynchogale</i>	<i>melleri</i>				Probably in SGR
	Hyaenidae	<i>Crocuta</i>	<i>crocuta</i>	CD		X	X
	Mustelidae	<i>Aonyx</i>	<i>capensis</i>			II	Widespread; SGR
	Mustelidae	<i>Ictonyx</i>	<i>striatus</i>				Widespread; SGR
Mustelidae	<i>Mellivora</i>	<i>capensis</i>				Widespread; SGR	
Mustelidae	<i>Poecilogale</i>	<i>albinucha</i>				widespread	
Viverridae	<i>Civettictis</i>	<i>civetta</i>				Widespread; SGR	
Viverridae	<i>Genetta</i>	<i>spp.</i>				Widespread; SGR	
Viverridae	<i>Nandinia</i>	<i>binotata</i>				might occur	
PERISSODACTYLA	Equidae	<i>Equus</i>	<i>burchellii</i>				widespread
	Rhinocerotidae	<i>Diceros</i>	<i>bicornis</i>	CR		formerly widespread	X
PHOLIDOTA	Manidae	<i>Manis</i>	<i>temminckii</i>	NT		widespread	widespread
PRIMATES	Cercopithecidae	<i>Cercopithecus</i>	<i>aethiops</i>			X	
	Cercopithecidae	<i>Cercopithecus</i>	<i>mitis</i>		I	X	
	Cercopithecidae	<i>Colobus</i>	<i>angolensis</i>		II	?	
	Cercopithecidae	<i>Papio</i>	<i>cynocephalus</i>		II	X	
PROBOSCIDEA	Elephantidae	<i>Loxodonta</i>	<i>africana</i>	EN	II	X	X
TUBULIDENTATA	Orycteropodidae	<i>Orycteropus</i>	<i>afer</i>				widespread

Table 22: Hyraxes, Lagomorphs and Rodents which may occur in the area, based largely on the general maps in Kingdon (1997) and unpublished SGR list.

ORDER	FAMILY	GENUS	SPECIES	IUCN 1996	CITES	REMP SURVEY, ETC	NOTES	
HYRACOIDEA	PROCAVIDAE	<i>Dendrohyrax</i>	<i>validus</i>				SGR	
		<i>Heterohyrax</i>	<i>brucei</i>				SGR	
LAGOMORPHA	LEPORIDAE	<i>Lepus</i>	<i>saxatilis</i>				Probable	
RODENTIA	ANOMALURIDAE	<i>Anomalurus</i>	<i>derbianus</i>		II		SGR	
	BATHYERGIDAE	<i>Heliophobius</i>	<i>argenteocinereus</i>	NT			SGR	
	CRICETIDAE	<i>Beamys</i>	<i>hindei</i>	VU		X		
	CRICETIDAE	<i>Cricetomys</i>	<i>gambianus</i>				SGR	
	CRICETIDAE	<i>Dendromus</i>	<i>sp.</i>				probable	
	CRICETIDAE	<i>Otomys</i>	<i>sp.</i>				probable	
	CRICETIDAE	<i>Saccastomus</i>	<i>campestris</i>				widespread	
			<i>Steatomys</i>	<i>Sp.</i>				probable
		GERBILLIDAE	<i>Tatera</i>	<i>spp.</i>			X	
		HYSTRICIDAE	<i>Hystrix</i>	<i>africaeaustralis</i>				SGR
			<i>Hyxtrix</i>	<i>cristata</i>				possible
		MURIDAE	<i>Acomys</i>	<i>spinosissimus</i>			X	
			<i>Aethomys</i>	<i>sp.</i>				SGR
			<i>Arvicanthis</i>	<i>niloticus</i>			X	
			<i>Dendromus</i>	<i>mystacalis</i>				SGR
			<i>Grammomys</i>	<i>dolichurus</i>			X	SGR
			<i>Grammomys</i>	<i>Spp.</i>				
			<i>Lemniscomys</i>	<i>rosalia</i>			X	SGR
			<i>Lophuromys</i>	<i>flavopunctatus</i>				
			<i>Pelomys</i>	<i>fallax.</i>				SGR
			<i>Praomys</i>	<i>natalensis</i>			X	
			<i>Mus</i>	<i>minutoides</i>			X	SGR
			<i>Pelomys</i>	<i>fallax</i>				
			<i>Praomys</i>	<i>delectorum</i>				Possibly in forest
			<i>Rattus</i>	<i>rattus</i>			commensal	SGR
			<i>Thallomys</i>	<i>Sp.</i>				possible
		MYOXIDAE	<i>Graphiurus</i>	<i>sp.</i>				probable
	PEDETIDAE	<i>Pedetes</i>	<i>capensis</i>	VU			widespread	
	SCIURIDAE	<i>Heliosciurus</i>	<i>gambianus</i>				SGR	
		<i>Paraxerus</i>	<i>palliatius</i>				SGR	
		<i>Paraxerus</i>	<i>flavovittis</i>				SGR	
	THRYONOMYIDAE	<i>Thryonomys</i>	<i>gregorianus</i>				widespread	
		<i>Thryonomys</i>	<i>swinderianus</i>				SGR	

Table 23: Bats from coastal forests

(KG=Kiwengoma; MC=Mchungu; NK=Namakutwa, TO=Tong'omba; SGR=unpublished list for Selous Game Reserve).

Classification	KG	MC	NK	TO	SGR	Notes
Megachiroptera						
Pteropidae:Fruitbats						
<i>Epomophorus labiatus</i>					*	
<i>Epomophorus wahlbergi</i>	*	*	*		*	
<i>Rousettus aegyptiacus</i>	*					Range extension
<i>Myonycteris relicta</i>	*			*		
Microchiroptera						
Nycteridae: Slit-faced bats						
<i>Nycteris aurita</i>						
<i>Nycteris grandis</i>				*		
Megadermatidae						
<i>Lavia frons</i>				-		
Rhinolophidae: Horseshoe bats						
<i>Rhinolophus deckeni</i>			*	*		
<i>Rhinolophus sp.</i>				*		
Hipposideridae:African leaf-nosed bats						
<i>Hipposideros ruber</i>	*		*	*		
<i>Triaenops persicus</i>	-			*		
Vespertilionidae:Vesper Bats						
<i>Pipistrellus nanus</i>	*		*			
<i>Pipistrellus sp.</i>				*		
<i>Scotophilus viridis</i>	*		*			
<i>Kerivoula africana</i>				*		Range extension
<i>Glaucocncteris variegata</i>			*			
Molossidae: Free-tailed Bats						
<i>Tadarida brachyptera</i>	*					Range extension

Table 24: Elephant Shrews (Macroscelididae) and Shrews (Soricidae) from REMP and the surrounding area

Classification	Genus and species	WE	KH	KG	MC	NK	SG R	Notes
Macroscelidea								
Macroscelididae: Elephant Shrews	<i>Petrodromus tetradactylus</i> Four-toed Elephant Shrew			*		*	*	
	<i>Rhynchocyon petersi</i> Rufous and Black E. Shrew		*		*		*	
Insectivora								
Soricidae	<i>Crocidura</i> spp.	*	*	*		*	*	Not possible to identify to specific level yet

Rodents are slightly easier to identify than shrews, although considerable taxonomic problems also exist. Other than for a few distinctive species, such as *Cricetomys gambianus* and *Beamys hindei*, there are few easily identifiable, distinctive species and so no lists of species from forests or other habitats of the REMP area and environs.

Larger rodents, such as Cane Rats, African Giant Rat, and other mammals of this size such as Hyrax, usually require specialised sampling techniques. Because these are usually regarded as prized food items, discussions with local residents may be able to indicate at least useful information on presence/absence and possible also on numbers and reproductive condition.

Small carnivores are probably the least-well studied mammal group. They can be difficult to trap generally; because of their size, they are a bit too large to be taken in the traps set for rodents. Even with larger traps, they require a flesh bait.

Primates: Primates are the object of a special study as part of REMP. Apparently, there are no valid records of Colobus monkeys from the area.

The most difficult to sample and identify are the nocturnal species, the Galagos or Bushbabies. The taxonomy of this group has recently been re-interpreted, further blurring the lines of what before were thought to be relatively clear species boundaries. Several new species have been described from Tanzania and their exact distributions remain to be defined

Table 25: Primates of the REMP area and environs

FAMILY	GENUS	SPECIES	COMMON NAME	IUCN	REMP	NOTES
CERCOPITHECIDAE						
	<i>Cercopithecus</i>	<i>aethiops</i>	Vervet Monkey		X	Widespread
	<i>Cercopithecus</i>	<i>mitis</i>	Blue (Mitis, Sykes') Monkey		X	Widespread
	<i>Papio</i>	<i>cynocephalus</i>	Yellow Baboon		X	Widespread
GALAGONIDAE						
	<i>Galago</i>	<i>moholi</i>	Mohol Lesser Galago			Widespread , miombo
	<i>Galago</i>	<i>senegalensis</i>	Senegal (Lesser) Galago, Bushbaby			Widespread , woodland
	<i>Galagoides</i>	<i>rondoensis</i>	Rondo Galago		?	Currently known only from Rondo dew forests
	<i>Galagoides</i>	<i>zanzibaricus</i>	Zanzibar Galago	NT		Coastal forest, thicket, etc.
	<i>Otolemur</i>	<i>crassicaudatus</i>	Large-eared Greater Galago			Widespread
	<i>Otolemur</i>	<i>garnettii</i>	Small-eared Greater Galago	NT		Widespread , coast
	<i>Otolemur</i>	<i>sp.</i>	Mwera Galago		?	Lindi, but possibly more widespread.

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9.2.5 Appendix 2.5 Fishes

Although surveys were conducted in rivers such as the Ruaha which eventually drain in to the Rufiji (Petr, 1974), and unpublished surveys were conducted as part of the environmental studies associated with the proposed Steigler's Gorge Dam (Bernacsek, Tagalala lakes, unpublished; Hopson, the Utete area and fisheries upstream, unpublished), there appear to be few detailed studies of fish in the REMP area. Bernacsek (1980) apparently based some of the distributions given in his general booklet on fieldwork conducted in the Rufiji. The most recent publication is that of Eccles (1992), on which the table below is based, focuses on fish species recorded as of some importance in fisheries and thus does not include many smaller, less conspicuous species, or those which for one reason or another are not regarded as food items.

Table 26: Fishes of the Rufiji River, based on Eccles (1992)

p = present, ? probably present but no specimen has yet been documented.

Classification	Common Name	Kiswahili Name	Rufiji River
PROTOPTERIDAE	Lungfish		
<i>Protopterus aethiopicus</i>	African Lungfish	Kamongo	?
MORMYRIDAE	Elephant-snouts		
<i>Mormyrus longirostris</i>			p
<i>Petrocephalus steindachneri</i>			p
CYPRINIDAE			
<i>Barbus macrolepis</i>			p
<i>Barbus radiatus</i>			p
<i>Labeo ulangensis</i>			p
<i>Opsaridium loveridgei</i>			p
DISTICHODONTIDAE			
<i>Distichodus petersii</i>		Tungu, Mbapale, Tungwi	p
<i>Distichodus rufigiensis</i>			p
<i>Nannaethiops sp.</i>			p
CHARACIDAE	African Tetras		
<i>Alestes imberi</i>			p
<i>Alestes jacksoni</i>			?
<i>Alestes stuhlmanni</i>		Kasa, Ngacha	p
<i>Hemigrammopetersius barnardi</i>			p
<i>Hydrocynus vittatus</i>	Tiger Fish		p
<i>Petersius conserialis</i>		Kasa, Ngacha	p
BAGRIDAE	Bagrid Catfishes		
<i>Bagrus orientalis</i>		Katoga, Kitoga	p
<i>Clarotes laticeps</i>			?
SCHILBEIDAE	Schilbeid Catfishes		
<i>Eutropiellus longifilis</i>			p
<i>Schilbe mystus</i>			p
AMPHILIIDAE	Loach Catfishes		
<i>Amphilius uranoscopus</i>			p

Table 26 cont.

Classification	Common Name	Kiswahili Name	Rufiji River
CLARIDAE	Air-breathing Catfishes		
<i>Clarias gariepinus</i>			p
MOCHOKIDAE	Squeakers		
<i>Synodontis fuelleborni</i>		Konge	p
<i>Synodontis maculipinna</i>			p
<i>Synodontis matthesi</i>			p
<i>Synodontis rufigiensis</i>		Nyanyandu	p
CYPRINODONTIDAE			
<i>Aplocheilichthys kongoranensis</i>			p
<i>Nothobranchius eggersi</i>	Annual Fish		p
<i>Nothobranchius foerschi</i>			?
<i>Nothobranchius kirkii</i>			?
<i>Nothobranchius melanospilus</i>			p
MASTACEMBELIDAE	Swamp and Spiny Eels		
<i>Afromastacembelus frenatus</i>			p
CICHLIDAE	Mouth Brooders		
<i>Oreochromis urolepis</i>			p
ELEOTRIDAE	Sleepers		
<i>Eleotris fusca</i>			p
GOBIIDAE	Gobies		
<i>Glossogobius giuris</i>			p

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