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## VOLUME I
## SYNTHESIS REPORT



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# *1. BACKGROUND*

The area surrounding Lake Cabora Bassa in Tete Province is relatively sparsely settled and little developed, particularly as compared to neighbouring portions of Zambia and Zimbabwe. The main forms of land use are small scale agriculture and fishing on Lake Cabora Bassa.

As elsewhere in Mozambique, the region has experienced a marked upsurge in economic and development activities since the end of the civil war in 1993. Settlements have been reestablished and have expanded to new areas. Small scale crop production has been revitalized, and new technologies such as cotton production are beginning to be adopted. Fishing activities on Lake Cabora Bassa have experienced a similar upturn. Plans are at an advanced stage for the construction of Mepanda Uncua dam downstream of Cabora Bassa, for the generation of additional hydroelectric power (Joint Venture, 1999).

In 1992 the Mozambican authorities established a community based natural resource management project, known as Tchuma Tchato. The main focus of the project, which has been implemented by Direcçao Provincial de Agricultura e Pecuaria (DPAP) Tete, has been on wildlife management and safari hunting. Additional revenues are generated through taxes on fishing activities. The lake also appears to offer good tourism potential. Tchuma Tchato are keen to exploit this, in order to generate additional income and so improve the viability of the project.

Wildlife and tourism activities appear to offer a more sustainable form of land use than agriculture, at least for the lower lying, more arid valley areas. However, there is a danger that the current agricultural expansion and associated development activities may rapidly erode biodiversity and tourism resources, and so compromise future biodiversity-based development options. DPAP are anxious to avoid such a situation, through influencing the development process for the region. In order to do this, they have identified a need for better biodiversity information, in a suitable format that can readily be drawn upon to inform the planning and development process.

The Ford Foundation, as part of its wider support to the Tchuma Tchato project, agreed to support a biodiversity and wilderness survey for the area surrounding Lake Cabora Bassa, and DPAP subsequently commissioned the Zambezi Society/Biodiversity Foundation for Africa (ZAMSOC/BFA) Partnership to carry out the work (Vol II, Appendix 1). It is recognised that there is significant overlap between the objectives of maintaining biodiversity and maintaining wilderness areas. Equally, there are also significant differences in requirements and approach to these two topics, meriting treatment as separate components of this study.

The Zambezi Society and the Biodiversity Foundation for Africa are two Zimbabwean based non-governmental conservation organizations, both of which have adopted a regional perspective covering the whole Zambezi Basin. The partnership has already undertaken a number of similar biodiversity projects, including the identification and conservation of sites of high botanical interest within the Zimbabwean portion of the Zambezi Valley (Cunliffe, 1996; Timberlake, 1996), and a biodiversity review of wetlands within the Zambezi Basin (Timberlake, 1998 & 2000). They have recently initiated a joint programme, the Zambezi Basin Initiative for Biodiversity Conservation (ZBI), the aims of which are to provide better biodiversity knowledge; to increase the use of biodiversity information in the planning process; and to conserve sites of high biodiversity importance, throughout the Zambezi Basin (BFA, FFI & ZAMSOC, 1999). The pilot phase of the ZBI focuses on the transnational area where Mozambique, Zambia and Zimbabwe come together. The Zambezi Society is also strongly committed to the maintenance of Zambezi wilderness areas, which are expected to become increasingly scarce and valuable resources (Wynn, 2000).

For the ZAMSOC/BFA Partnership, the Cabora Bassa biodiversity and wilderness survey offers an important proactive conservation opportunity, through which biodiversity and wilderness concerns for this region can be identified and incorporated into the planning and development process at a relatively early stage of development, when most natural resources are still largely intact.

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## *2. STUDY AREA AND APPROACH*

### A. THE STUDY AREA

The study area was identified by DPAP as consisting of the major portion of the Tchuma Tchato project area surrounding Lake Cabora Bassa. To the south of the lake, this includes Magoé and Cahora Bassa districts and, to the north, Zumbo and much of Maravia District, all within Tete Province (Maps 1 & 2). The overall area is just over 43,000 km$^2$, and is split fairly equally to the north and south of the lake.

**Physical Setting**

The region covers part of the Zambezi Valley and, north of Lake Cabora Bassa, the adjacent uplands. The portion to the south of the lake is virtually all valley terrain, other than very limited exposures of basement country in the vicinity of Songo, and to the extreme southeast where the area just extends onto the southern escarpment. To the north of the lake, the valley area is much more restricted, being confined to a relatively narrow strip less than 20 km wide to the west; the bulk of the terrain consists of escarpment and upland plateau country. The boundaries between the valley and upland components are fault-determined and clear.

The valley mainly consists of Cretaceous and Karoo sediments, predominantly sandstones (Map 3). There is a prominent Jurassic basalt outcrop to the southeast, known as the Luia dome. There are also small but important occurrences of Pleistocene terraces and of more recent alluvial and colluvial deposits. The northern upland areas mainly consist of Precambrian granites and gneisses, with small irregular occurrences of metasediments, and mafic and ultramafic intrusions.

The low-lying valley area (around 400-500 m altitude) is centred on the Zambezi River and Lake Cabora Bassa. Major tributaries to the south are the Angwa/Panyame, Musengezi and Daque drainages, none of which are perennial. The southeastern portion is drained by the Luia River and its major tributaries, the Metangua and Canguedze. The Luia joins the Zambezi River downstream of Tete, which is outside the study area. To the north the major drainage is the Luangwa River which enters the Zambezi just upstream of the top end of Lake Cabora Bassa. A number of smaller rivers drain from the escarpment area directly into Cabora Bassa.

The Zambezi River splits into a series of channels interspersed by broad sandbanks immediately downstream of its confluence with the Luangwa. This portion extends for some 15km to the upstream end of the lake. There are two sets of prominent spits and islands within the lake, to the east of the Musengezi inlet and just east of Daque (see Map 6). The most spectacular section, however, is the easternmost 35km of the lake, where the water is confined within a narrow gorge flanked by high cliffs. The gorge continues downstream of the dam wall, and does not open up until some 65 km further downstream, outside the study area.

Conspicuous features within the valley (see Map 7) are: Comboio, a prominent raised plateau area between Mukumbura and Daque; the sandstone ridge running east-west immediately behind Magoé; and Mt. Bungue just south of Daque. Further south, there are some marked hills within the Luia basalt area.

The escarpment zone to the north of the lake is an area of rugged broken country that gradually increases in altitude to a plateau at some 900-1 100m amsl. The plateau is interspersed with several prominent ranges, and with additional isolated hills. Towards the extreme north, the country becomes gentler, with thickly wooded rises separated by well-developed dambo areas.

Climate is strongly seasonal, being dominated by a long dry season from May to November. Annual rainfall is related to altitude, varying from about 600-800mm for the valley portion, but increasing markedly to about 1 000-1 200mm for the northern plateau area. Mean annual temperatures are relatively high within the valley, but milder on the plateau. The valley environment is thus strongly semi-arid, with moisture being the major limiting factor for plant growth, whilst conditions on the plateau are considerably more mesic.

Apart from the alluvial and colluvial deposits, the development of soil within the valley is typically shallow and directly related to the underlying geology. The Luia basalt gives rise to areas of clay-rich soils and, in the surrounding low-lying parts, to clay-rich colluvium and alluvium. To the north of the lake, soils on the steep escarpment hills are skeletal, but weathering is far more pronounced on the plateau areas where the climate is moister and the terrain gentler, resulting in soils of reasonable depth.

**Land use**

The pattern of settlement still bears the marks of the protracted civil war. It is strongly related to the positioning of roads and, particularly within the valley, to the lake and the major drainages. Most of the area remains relatively sparsely settled.

Small scale agriculture is the main form of land use in both the valley and upland areas, although conditions to the north are far more favourable. Livestock are often absent, or restricted to low numbers, and most of the cultivation is done by hand. Maize appears to be the main crop grown throughout. Cotton production has started in the southern valley portion, from where it is marketed in Zimbabwe.

The principal wildlife populations occur south of the lake, to the west of the Musengezi inlet, and are contiguous with significant populations in the adjacent portions of Zimbabwe. Other smaller populations occur in the vicinity of Daque, on the Luia basalt dome, and to the east in association with the Luia River and its tributaries, but relatively little is known about these occurrences. The valley portion to the north of the lake appears to offer excellent potential for wildlife, but populations seem to have been reduced to very low levels. Safari hunting is carried out to the west of the Musengezi, and forms an important component of the Tchuma Tchato project.

Lake Cabora Bassa was built for the generation of hydroelectricity. Plans are at an advanced stage for the construction of another, smaller dam on the Zambezi at Mepanda Uncua, between Cabora Bassa and Tete (just outside the study area), also for the generation of hydropower. Lake Cabora Bassa also supports important inshore and kapenta fishing industries. Kapenta operations are concentrated at the eastern end of the lake, but the inshore fishing has resulted in the development of small fishing villages scattered all around the lakeshore. Crocodile harvesting operations have previously been carried out. Tourism potential appears high, but other than limited sport fishing there has been little development as yet.

The southern portion of the study area has no significant timber resources, but there are believed to be reasonable volumes to the north, particularly of mukwa (*Pterocarpus angolensis)*. The poaching of timber is said to be a serious problem along the Zambian border.

There are no significant mining operations within the study area. Relatively large coal reserves occur in association with Karoo sediments on the north bank of Cabora Bassa, some of which were submerged by the lake. The economic potential for most of these deposits is limited by their poor quality, although the largest occurrence at Moatize, near Tete, is currently being exploited.

## B. APPROACH

The findings detailed in this synthesis are drawn from several desk and field activities, described in full in Volume II. These activities were as follows:

- Existing information concerning the biodiversity of the study area was collated and reviewed (Timberlake, Vol. II, Appendix 2).
- An overall ecological stratification of the project area was carried out utilising LandSat TM satellite imagery (Cunliffe, Vol II, Appendix 3).
- The initial interpretation was subsequently verified and modified for the area *south of lake Cabora Bassa* through aerial observations (April/May 2000) and limited field sampling (June 2000). This data provided the basis for descriptions and analyses of vegetation communities for this area (Cunliffe, Vol II, Appendix 3).

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- Field sampling was also planned for the portion of the project area lying *north of Lake Cabora Bassa,* but this proved over-ambitious in terms of time and cost. The identification and description of vegetation communities north of the lake rely on the satellite imagery interpretation, together with limited aerial survey, and on the review of existing information.

- A bird survey of the area south of Lake Cabora Bassa (Chiweshe, Vol II, Appendix 4) was carried out in conjunction with the plant survey.

- The lake shore was thought to be a key area in terms of both biological communities and development activities. Lakeshore plants and vegetation (Timberlake, Vol II, Appendix 5) and birds (Douglas, Vol II, Appendix 6) were surveyed in June 2000. The lake was traversed from Songo to Zumbo and back, using the research vessel "Pende" supplied by the Mozambican authorities.

For each of the field studies, authors were tasked with producing a species list and an analysis of species distributions by ecological community; identifying species and areas of particular biodiversity conservation interest; and with providing recommendations concerning the future development of the area that would limit impacts on key biodiversity resources. An additional component for the terrestrial vegetation study was the identification of areas of wilderness importance and for the implementation of wilderness based tourism activities.

Although not specifically called for, the species lists from the two plant surveys were subsequently combined with a previously published list for Tete Province, to produce an overall plant species list for the Tchuma Tchato project area (Timberlake, Vol II, Appendix 7.)

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# *3. LITERATURE SEARCH, ECOLOGICAL STRATIFICATION & FIELD SURVEYS*

## A. LITERATURE SEARCH

The principal result of the literature research (Timberlake, Vol II, Appendix 2) was to reveal just how little is known about the biodiversity of Lake Cabora Bassa and the surrounding areas, thus emphasizing the need for the current study. A total of 68 references were located, of which 34 are directly relevant to the biodiversity and renewable natural resources of the study area. The remaining 34 are considered useful, but peripheral. Compared to the Zimbabwe portion of the mid-Zambezi Valley, this absence of information is remarkable.

Comparatively speaking, there is adequate coverage on fish composition and lake fisheries. There have also been some good studies of the effects of lake formation on aquatic ecology in the initial years, particularly of aquatic weeds and of the impact of the dam on downstream hydrology and ecology, but these need to be followed up. In particular, many more studies are required on terrestrial biodiversity in order to obtain a clearer idea of the species present, and of their conservation status and importance, as is the purpose of this study.

## B. ECOLOGICAL STRATIFICATION

This section should be read in conjunction with Maps 3-5, which are critical to an understanding of the ecological stratification of the project area. Map 3 is a simplified geological map, while Map 4 depicts the results of the ecological stratification. Map 5 shows Lake Cabora Bassa and its shoreline. Vegetation within the project area is, with the exception of the colluvial and alluvial areas, closely associated with the underlying geology.

### *i. South Of Lake Cabora Bassa (Map 4 and Table 1)*

Sixteen vegetation types are mapped and described for the area south of Lake Cabora Bassa. These are classified under four groups:

- Most of the area is dominated by extensive mopane woodlands on a variety of Karoo sediments and the Luia basalts (Type 3, five units).
- Smaller but important occurrences of riparian forest, woodland and grassland on alluvium and colluvium (Type 1, four units), are scattered throughout the area.
- Dry *Xylia* forests, thickets and *Combretum/Terminalia* wooded bushland on unconsolidated sands (Type 2, four units).
- The vegetation of the basement terrain around Songo, and on the southern escarpment, is described under three units, none of which were adequately sampled. These are grouped together as Type 5.

### *ii. North of Lake Cabora Bassa (Map 4 and Table 1).*

To the north of the lake, the absence of any sampling makes the depiction of units much less certain, particularly for the basement portion. Nor is it possible to provide detailed descriptions for the proposed units. Given these constraints –

- The valley portion appears to include much the same mix of types as the area south of the lake. Thirteen communities are identified from here, including one which is absent from the southern portion (Type 2.5, *Terminalia* open woodland).
- The extensive upland area is divided into three mopane/mixed communities (Type 6), which occur as a block to the east, with the remainder being covered by eight miombo-related types (Type 7).

- The separation of the upland units appears to be based primarily on gradients from low to higher altitude, from drier to moister environments, and from lithosols to better developed deeper soils.

- Apart from the small patches of bamboo thicket (Type 7.7) and grassland on serpentine hills (Type 7.8), the other northern basement units are all relatively extensive (1 000-5 000 km$^2$).

***iii. Lake & Lake Shore (Maps 4& 5 and Table 1)***

Additional information from the lake shore plant and vegetation surveys confirmed that the lake shore is dominated by various types of mopane woodland, except for the gorges and cliffs at the eastern end of the lake, which support a more mixed open woodland, with denser patches in gullies. In addition, three aquatic and semi-aquatic types were identified:

- Sandbanks, often supporting *Phragmites* reedbeds;

- Alluvial flats, also sometimes supporting *Phragmites* reedbeds; and

- Floating aquatic vegetation.

The sandbanks and alluvial flats are mapped together as Type 4.1, and floating aquatic vegetation as Type 4.2, on the overall vegetation map (Map 4), but are shown in greater detail on Map 5.

*Table 1. Classification of vegetation units within the project area*

| |
|---|
| ***UNITS TO THE SOUTH OF LAKE CABORA BASSA*** |
| **TYPE 1: VEGETATION ON ALLUVIUM/COLLUVIUM** |
| Type 1.1 - River Beds and Lowest Alluvial Terraces |
| Type 1.2 - Riparian Forest |
| Type 1.3 - Mixed Woodland on Sandy Alluvium and Colluvium |
| Type 1.4 - Seasonally Inundated Grassland on Clay Alluvium |
| **TYPE 2: DRY FOREST, THICKET AND WOODLAND TYPES ON UNCONSOLIDATED SANDS** |
| Type 2.1 - *Xylia* Dry Forest |
| Type 2.2 - Mixed Dry Thicket and Woodland |
| Type 2.3 - *Terminalia brachystemma* Thicket to Wooded Bushland |
| Type 2.4 - *Julbernardia*/*Terminalia* Woodland on Comboio |
| **TYPE 3: UNITS ON KAROO AND BASALT FORMATIONS** |
| Type 3.1 - Mixed Woodland on Sandstone Ridges and Hills |
| Type 3.2 - *Diospyros*/*Combretum*/Mopane Low Open Woodland on Shallow Sandstone Soils |
| Type 3.3 - *Mopane/Combretum/Terminalia* Low Open Woodland on Shallow Basalt Soils |
| Type 3.4 - Mopane/Mixed Woodland |
| Type 3.5 - Mopane Woodland on Deeper Depositional Soils |
| **TYPE 5: UNITS ON SOUTHERN BASEMENT GEOLOGY** |
| Type 5.1 - Mixed Miombo Woodland on Songo Gneiss |
| Type 5.2 - *Brachystegia allenii* Escarpment Open Woodland on Gneiss |
| Type 5.3 - Mixed Dry Thicket on Gneiss |
| ***ADDITIONAL UNITS TO THE NORTH OF LAKE CABORA BASSA*** |
| **TYPE 2: DRY FOREST, THICKET AND WOODLAND TYPES ON UNCONSOLIDATED SANDS** |
| Type 2.5 - *Terminalia* Open Woodland |
| **TYPE 6: MOPANE/MIXED UNITS ON NORTHERN BASEMENT GEOLOGY** |
| Type 6.1 - Mopane/Mixed Open Woodland on Lithosols |
| Type 6.2 - Mixed Deciduous Woodland |
| Type 6.3 - Mixed Mopane/Miombo Woodland |
| **TYPE 7: MIOMBO/OTHER UNITS ON NORTHERN BASEMENT GEOLOGY** |
| Type 7.1 - Open Woodland on Dry Lithosols |
| Type 7.2 - Denser Woodland on Moister Lithosols |
| Type 7.3 - Western Miombo Open Woodland |
| Type 7.4 - Southern Miombo Open Woodland |
| Type 7.5 - Central Miombo Closed Woodland |
| Type 7.6 - Northern Miombo Closed Woodland |
| Type 7.7 - Bamboo Thickets |
| Type 7.8 - Serpentine Grasslands |
| ***CABORA BASSA LAKE SHORE*** |
| **TYPE 4: AQUATIC UNITS** |
| Type 4.1 - *Phragmites* Reedbeds on Sandbanks |
| Type 4.2 - Floating Aquatic Vegetation |

## C. SPECIES OF INTEREST

### *i. Plant Species*

The recording of plant species was confined to the part of the project area that lies south of Lake Cabora Bassa, and was mainly focused on trees, lianes and perennial woody shrubs. A total of 301 species were noted. Of these, 58 were identified as being of potential conservation interest, based mainly on their known extent of distribution rather than on any knowledge of their current status or perceived threats to their populations. These include (Table 2):

- Six apparently new records for Mozambique;
- Five species for which very few other records exist for this area;
- Seven species which are near the extreme southern or northern extent of their range;
- Three near-endemic species; and
- Two species which, if correctly identified, represent significant extensions to their known ranges.

*Table 2. Plant species of particular interest recorded during vegetation survey to the south of Lake Cabora Bassa, June 2000.*

| **FAMILY/Species** | **Notes** |
|---|---|
| ACANTHACEAE | |
| *Anisotes bracteatus* | New record for Mozambique, uncommon in Zimbabwe |
| *Anisotes formosissimus* | One other record from Tete Province, none from northern Zimbabwe |
| ASTERACEAE | |
| *Psiadia punctulata* | New record for Mozambique |
| *Tarchonanthus camphoratus* | New record for Mozambique |
| BURSERACEAE | |
| *Commiphora zanzibarica* | Near southern extent of range |
| CAPPARACEAE | |
| *Maerua buxifolia* | Possible new record for Mozambique |
| CELASTRACEAE | |
| *Maytenus pubescens* | Northern extent of range, not common |
| COMBRETACEAE | |
| *Combretum goetzei* | Southern extent of range |
| *Combretum kirkii* | Southern extent of range |
| DIPTEROCARPACEAE | |
| *Monotes katangensis* | Southern extent of range |
| FABACEAE: MIMOSOIDEAE | |
| *Mimosa mossambicensis* | Also occurs further north, but endemic to Mozambique |
| *Newtonia hildebrandtii* | Few records from this area |
| FABACEAE:PAPILIONOIDEAE | |
| *Crotalaria monteiroi* | Second record from this area |
| *Rhynchosia wildii* | Third record from this area, endemic to the Zambezi Valley |
| MALPIGHIACEAE | |
| *Caucanthus auriculatus* | Near southern extent of range |
| MELIACEAE | |
| *Trichilia capitata* | Near southern extent of range, only recorded from Luia drainage where it is common, single record from Zimbabwe |
| *Turraea zambesica* | Endemic along Zambezi River |
| OCHNACEAE | |
| *Brackenridgea zanguebarica* | Significant extension of range (if correct), occurs southern Zimbabwe and adjacent portion of Mozambique |
| *Ochna multiflora* | Significant extension of range (if correct), occurs in higher rainfall areas of NW Zambia |
| POACEAE | |
| *Elytrophorus globularis* | New record for Mozambique |
| RHAMNACEAE | |
| *Ziziphus pubescens* | Present but uncommon |
| RUBIACEAE | |
| *Psydrax martinii* | Possible new record for Mozambique |

The other 36 taxa represent interesting records (relatively unusual occurrences, uncommon, or of uncertain conservation status), but are of lesser importance. The paucity of endemic species is not surprising, as the study area forms part of a larger ecological system which continues into the neighbouring portions of Zimbabwe and Zambia.

One or more species of interest were recorded from virtually all the types sampled to the south of the lake, as follows: -

- 22 species from Type 3.1 mixed woodland on sandstone ridges and hills;
- 10 species from Type 2.2 mixed dry thicket and woodland on sands;
- Nine species from Type 1.3 mixed woodland on sandy alluvium/colluvium;
- Nine species from the extensive Type 3.4 mopane/mixed woodlands;
- Seven species from Type 1.2 riparian forest; and
- Seven species from Type 2.1 *Xylia* dry forest.

Further collecting, particularly of herbaceous species, would be likely to result in the identification of additional species of interest. Two areas stand out as being particularly worthy of investigation, these being the serpentine grasslands to the north of the lake (Type 7.8), and the grassland dambo areas within the northern closed miombo woodland to the extreme north of the study area (Type 7.6).

As regards the lake: one species of particular interest, *Sesbania cinerascens*, was relatively common on the sandbanks at the western end of Cabora Bassa. This species has not previously been recorded from the mid-Zambezi Valley, although it is found on the upper Zambezi from Botswana, Zambia and Angola. The presence of the tall labiate weed *Hyptis suavolens* represents a significant range extension from Chimoio. No other particularly unusual or rare plant species were found. However, it is characteristic of most wetland and shoreline species that they are widespread.

The presence of a number of invasive aquatic weeds, such as *Azolla filiculoides*, *Eichhornia crassipes, Pistia stratioites* and *Salvinia molesta*, was noted, but levels of infestation were relatively low. This is assumed to be because the lake is not eutrophic (nutrient enriched), due to low nutrient inputs and high through-flow.

***ii. Bird Species***

A total of 251 bird species was noted during the survey of the area to the south of the lake (Table 3). Species of particular interest included the Long-toed Plover and the Little Spotted Woodpecker, both of which were outside their known distribution ranges. Several intra-African migrants which had overstayed in this region were recorded, including the Striped Cuckoo and Greyhooded Kingfisher. The distribution and abundance of hornbills was also interesting. The Red-billed and Crowned Hornbills were common to the west of 32° 00'E longitude, while the Grey and Yellow-billed Hornbills were commonly seen to the east of this line.

*Table 3. Numbers of bird species recorded from the seven main habitat types to the south of Lake Cabora Bassa, June 2000.*

| HABITAT | NO. OF SPECIES |
|---|---|
| Riverine forest and lake shore | 173 |
| Mopane/mixed mopane woodland | 144 |
| *Acacia*/mixed *Acacia* woodland | 119 |
| Grassland/wooded grassland | 103 |
| Mountain/Hills (sandstone/basalt) | 98 |
| *Combretum* thickets and mixed woodland | 77 |
| *Terminalia* clumped to mixed woodland | 69 |
| **TOTAL** | **251** |

Another interesting species was Arnot's Chat. Despite the fact that the whole study area was dominated by mopane woodland, which is the preferred habitat for this species (and much of which was undisturbed), it was only recorded to the west of the 30° 45'E longitude line (west of the Musengezi inlet).

Other species of interest include four species of vultures, and a good variety of other diurnal raptors (23 species), including healthy numbers of young individuals. Hawks and snake eagles were particularly

abundant, including the relatively rare Western Banded Snake Eagle. African Fish Eagle were observed to be doing particularly well along the lakeshore. Seven sunbird species were also recorded, as were Crested Guineafowl.

The lakeshore survey noted 163 species (Table 4), of which approximately 33% were aquatic. The survey drew attention to interesting observations of a number of aquatic species including the African Skimmer and Carmine Bee-eater, both of which have relatively restricted global distributions. High densities of African

*Table 4: Total and aquatic bird species for Cabora Bassa lakeshore communities, June 2000*

| COMMUNITY | NUMBER OF SAMPLES | TOTAL OBSERVATION TIME (HRS) | TOTAL SPECIES | AQUATIC SPECIES |
|---|---|---|---|---|
| Gorge | 4 | 7.50 | 100 | 25 |
| Mopane woodland | 9 | 7.25 | 92 | 37 |
| Sandbanks | 1 | 0.75 | 52 | 28 |
| Alluvial Flats | 4 | 5.50 | 95 | 44 |
| **TOTAL** | **18** | **21.00** | **163** | **55** |

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Fish Eagle were again noted. A number of migratory species were recorded that appear to be overwintering here, including the Whitewinged Tern, Greyhooded Kingfisher, Carmine Bee-eater, Whitethroated Swallow, Banded Martin and European Golden Oriole.

There are eight Globally Threatened bird species that may occur within the study. None of these were recorded, although Douglas (Vol II, Appendix 6) noted the possible presence of a pair of Taita Falcon on cliffs in the gorge. Five of the other species are Palaeartic migrants, which by June would be expected to have already left the study area.

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# *4. BIODIVERSITY CONSERVATION AREAS*

## A. INTRODUCTION

A number of potential biodiversity conservation areas were identified at various scales on the basis of the information summarised in the preceding section.

The aim of identifying sites and areas of biodiversity conservation interest was twofold:

- To draw attention to specific sites of particular interest, which should be regarded as priorities for conservation actions, and
- To identify those portions of the overall landscape with significant biodiversity resources which should be given particular consideration in terms of future planning and development.

The ecological stratification (Map 4) provides the framework for consideration of plant biodiversity across the entire study area. For birds, it was necessary to confine considerations to the area south of Cabora Bassa in the absence of any data from the north of the lake. The lakeshore plant and bird surveys facilitated the identification of more specific areas of biodiversity interest around the lake.

A tiered approach was used to identify sites and areas of particular plant biodiversity interest, based on examining the overall area at different spatial scales. This resulted in the identification of increasingly larger areas, but with decreasing precision. Section B below identifies important vegetation units across the broad project area, excluding the lake and lake shore, while Section C identifies larger landscape units that include examples of one or more of these vegetation units. The immediate environs of Lake Cabora Bassa are described in Section D, while important bird areas for both components are noted under Section E. Suggestions for large-scale biodiversity conservation areas are made in Section F.

## B. UNITS OF IMPORTANT PLANT DIVERSITY, EXCLUDING THE IMMEDIATE LAKE ENVIRONS (MAP 6)

At the finest level, and based on a subjective combination of species composition, extent and perceived level of threat, eight of the terrestrial vegetation units identified from the ecological stratification and the ground surveys were identified as being of highest importance for biodiversity conservation (Table 5). The extent of these units, as far as is known, is shown on Map 6. They are:

- **The four alluvial/colluvial types** (Types 1.1-1.4). The principal occurrences of these types are in association with the major rivers, particularly the Luangwa, Angwa, Panyame and Luia.
- ***Xylia* dry forest** (Type 2.1), confined to a limited number of small patches in the western valley portions to either side of the lake.
- **Mixed woodland on sandstone ridges and hills** (Type 3.1), occurring as scattered patches within the southern valley portion between Magoé and the southeastern corner of the study area.
- **Bamboo thickets** (Type 7.7), principally found within the northern closed miombo woodland unit to the north of the lake.
- **The serpentine grasslands** (Type 7.8), within the rugged escarpment zone.

This includes communities that are particularly diverse (Types 1.2, 1.3 and 3.1); with many species of interest (Types 1.2, 1.3, 2.1, 3.1 and probably 7.8); of limited extent (Types 1.1, 1.4, 2.1, 7.7 and 7.8), and under

significant threat of modification, particularly through clearing associated with cultivation and settlement (Types 1.2, 1.3, and 7.7).

No attempt was made to judge the condition of individual patches, or to place them into any order of priority for conservation action.

*Table 5: Eight terrestrial vegetation types of greatest biodiversity conservation interest for the Tchuma Tchato project area surrounding Lake Cabora Bassa.*

| VEGETATION TYPE | IMPORTANCE IN TERMS OF SPECIES COMPOSITION | EXTENT ($KM^2$) | | LEVEL OF THREAT |
|---|---|---|---|---|
| | L = low<br>M = moderate<br>H = high | L = large<br>M = moderate<br>S = small | | L = low<br>M = moderate<br>H = high |
| 1.1 Lowest alluvial terraces | M | (1,144) | S | M |
| 1.2 Riparian forest | H | | M | H |
| 1.3 Mixed woodland on sandy alluvium/colluvium | H | (474) | M | H |
| 1.4 Seasonally inundated grassland on clay alluvium | L | (31) | S | M |
| 2.1 *Xylia* dry forest | H | (175) | S | M |
| 3.1 Mixed woodland on sandstone ridges & hills | H | (676) | M | L |
| 7.7 Bamboo thicket | L | (154) | S | H |
| 7.8 Serpentine grassland | H | (114) | S | L |

## C. LANDSCAPE FEATURES OF INTEREST, EXCLUDING THE IMMEDIATE LAKE ENVIRONS (MAP 7)

At a larger scale, the next step was to identify a number of features of known and apparent interest, consisting of clearly recognizable elements within the landscape. Some of these include portions of several of the above units of interest. Others are drawn from subjective observations made during the terrestrial surveys. These are shown on Map 7**.**

- ***Luangwa colluvial fan*** - a prominent area of alluvial/colluvial depositional soils extending from the base of the escarpment to the Luangwa River and supporting, amongst other types, what appears to be a particularly well developed portion of *Xylia* dry forest. ***This is possibly the most important conservation site within the whole study area.***

- ***Gonono sand ridge*** - situated to the southwest and straddling the international border with Zimbabwe, this low sand ridge supports important occurrences of high priority mixed woodland on sandy colluvium (Types 1.3) and *Xylia* dry forest (Type 2.1), together with good representative examples of Types 2.2 and 2.3 (sand thickets and woodlands).

- ***Comboio plateau***- this prominent isolated plateau feature, situated between Mukumbura and Daque, is dominated by Type 2.4 *Terminalia-Julbernardia* woodland, which was not identified from elsewhere in the study area. The slopes support varied occurrences of Type 3.1 hillside thicket vegetation, from which a considerable number of species of interest were recorded. Comboio is also considered to be a sacred area, and during the wet season supports low numbers of elephants.

- ***Luia alluvium*** - for some 10km after it emerges from the Zimbabwean escarpment hills the lower Luia River is flanked by prominent alluvial/colluvial deposits which support a particularly varied range, and with well-developed examples, of Type 1 and Type 2.2 communities.

- ***The sandstone ridge*** behind Magoé; ***Mt. Bungue*** near Daque Camp; ***Mt. Changaudze*** to the extreme southeast beside the Luia River; and ***Mt Ngosi***, the marked conical feature to the north of the lake opposite the Musengezi inlet. These support varied occurrences of the diverse Type 3.1 mixed woodland and thicket on steep slopes.

**D. LAKE CABORA BASSA & IMMEDIATE ENVIRONS (MAP 5)**

The ecological stratification and the lakeshore surveys identified a number of features considered to be of conservation interest for a variety of reasons, as follows:

- The gorges at the eastern end of the lake. A good example of this type, with high tourist appeal, should be identified and managed for conservation purposes.

- The gneiss islands in the middle of the eastern basin (around 15° 38'S 32° 07'E). These are typical of a wide area, have been little disturbed by human activities, and are of high scenic value.

- The peninsula to the west of Magoé (around 15°44'S 31°37'E). This includes rhyolite and Karoo sandstone exposures that are typical of much of the lakeshore. Fossil wood is also present.

- The areas around the Musengezi mouth (around 15°55'S 31°07'E) and the Zambezi mouth (around 15°38'S, 30°40'E) support the most extensive developments of aquatic vegetation, and are believed to be important for fish breeding.

- The bay into which the Panyame runs (around 15°39'S 30°40'E) is characteristic of a number of larger bays that provide a reasonable diversity of habitats, and thus species, ranging from those on Karoo sandstone to alluvium to floating aquatic vegetation.

- Some of the sandbanks at the mouth of the Zambezi, just downstream of Zumbo (15°39'S 13°33'E) should be conserved. Although not particularly rich in terms of plant species, these are the only examples of this habitat on the lake, often support extensive *Phragmites* reedbeds, and provide important habitats for waterbirds.

**E. IMPORTANT BIRD AREAS (NOT MAPPED)**

The high mobility of birds makes it more difficult to identify specific areas of conservation importance. However, certain habitats stand out as being of particular interest because they support the most diverse communities or important populations of particular species of conservation interest. Specific bird areas are not demarcated on the associated maps, but the relevant habitats are shown on Maps 4 & 5.

***To the south of the lake, the areas with highest bird diversities were those in proximity (within 5km) to perennial water along the lakeshore and the major rivers*** (Chiweshe, Vol II, Appendix 4.) The distribution of such areas along rivers should correspond reasonably well to the portion mapped as riparian forest (Type 1.1 Map 4). These alluvial areas are also key sites for human settlement and cultivation, resulting in considerable modification and associated impacts. Any permanent springs or pans should also be considered as conservation priorities.

***For the lakeshore, the alluvial flats and sandbanks were identified as being of greatest bird conservation importance, particularly for aquatic species.*** These are restricted to scattered small occurrences at the western end of the lake (Map 5) and are also subject to relatively intensive levels of use and modification by lakeshore fishing communities. The gorge area was also highlighted as being of particular relevance for certain species that are dependent on cliff or mountain habitats.

The area to the north of the lake was not examined, but is certain to harbour additional areas of particular bird interest.

**F. BROAD AREAS OF BIODIVERSITY INTEREST (MAP 8)**

At a coarser landscape scale the identification of broader areas of conservation interest was based on the incorporation of a wide variety of units, and thus overall diversity, within a relatively confined area (roughly 30 x 50km). Ten such areas of interest were identified. These include the bulk of the units and features of interest

identified above. All ten areas are focused on the valley portion, although several include representation of adjacent upland units:

- ***Areas A1, A2 and A3*** are situated to the north-west of the lake, collectively including virtually the entire northern valley portion;
- ***Areas A4 and A5*** cover the western half of the valley portion to the west of the Musengezi inlet; and
- ***Areas A6-A10***, to the southeast, in association with Comboio, the Daque River and the Luia drainage

The grouping of these areas of interest suggests two extensive regions of greatest plant biodiversity importance, situated to the west and east respectively:

The **western** region covers the valley portion to the west of the Musengezi inlet, and to either side of the lake.

The **eastern** region stretches from Comboio, southeast across the Luia basalt dome and the valley system associated with the Metangua and Canguedze drainages, into the hills on the southeastern border of the study area.

These results highlight the biodiversity resources of the valley portion rather than the upland areas. Whilst this appears to be valid, the possibility remains that this may, at least in part, be an artefact of the lack of data from the northern portion.

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## *5. IMPORTANT WILDERNESS AREAS*

### A. GENERAL (MAP 9)

Identification of areas of wilderness importance was based on a combination of criteria. These were: extensive area; low levels of settlement; minimal potential for crop production; but good potential for wildlife and tourism developments. Eleven areas of potential wilderness value were identified. These are:

- ***W1: Luangwa Valley,*** covering the northern half of the valley area between the Luangwa River and the escarpment;
- ***W2: Western Lakeshore,*** from downstream of Zumbo to opposite the Musengezi inlet, and extending north into the escarpment;
- ***W3: Western Uplands,*** to the north of the lake, consisting of the broken western portion of the escarpment and hills between the valley area and the gentler plateau terrain to the north and east;
- ***W4: Islands east of Musengezi Inlet,*** including the narrow spits protruding from both the southern and northern shores, and extending back into the northern escarpment area;
- ***W5: Panyame West,*** covering the entire block to the west of the Panyame and Angwa Rivers, up to the Zimbabwe border;
- ***W6: Panyame East,*** continuing east from the Panyame River to include the important Gonono sand ridge area, but stopping short of the Musengezi inlet;
- ***W7: Eastern Lakeshore and Gorge,*** covering a significant length of the northern lakeshore, the gneiss islands in the eastern bay, and the gorge area along the lake and continuing downstream along the Zambezi River;
- ***W8: Eastern Uplands,*** extending north into the rugged broken country from W7;
- ***W9: Comboio,*** including the plateau and surrounding deeply dissected valley terrain;
- ***W10: Luia Basalts,*** including virtually the entire basalt dome, together with the important alluvial feature where the Luia River first enters Mozambique from Zimbabwe;
- ***W11: Eastern Valley,*** extending east from the Luia basalt dome, across the intervening valley portion, onto the hills to the extreme east of the study area.

These portions make up four blocks (Map 9):

- ***To the northwest,*** the western valley portion and adjacent escarpment hills (W1-W4);
- ***To the southwest***, the area to the west of the Musengezi inlet (W5-W6);
- ***To the northeast,*** the northern lakeshore, gorge area and adjacent hills (W7-W8); and

- ***To the southeast,*** extending from Comboio, across the Luia basalt area and adjacent eastern valley portion into the eastern hills (W9-W11).

Collectively, these areas include roughly half the total study area, which serves to highlight the good wilderness potential of this Cabora Bassa region. The excluded areas are much of the southern lakeshore and adjacent valley terrain and, to the north of the lake, the bulk of the central plateau area.

**B. THE LAKE SHORE (MAP 5).**

The gorge is the most striking part of the lakeshore from a perspective of potential wilderness-based ecotourism development, although the surrounding areas support relatively high intensities of settlement, and most of the slopes have already been extensively modified through clearing for cultivation. To the extreme west, the riparian woodland along the Zambezi River, with its large trees, is likely to contain suitable sites for the development of lodges and camps, as is the case just upstream within Zimbabwe.

Within the extensive mopane woodland shoreline area, sites of particular scenic value include the gneiss islands in the eastern basin; the Magoé basalt peninsula (where fossil wood was also noted); the spits and islands to the east of the Musengezi inlet, and several small bays on the southern shore between the Musengezi and Panyame bays.

The aquatic vegetation, sandbank and alluvial flats are inherently less attractive, but are favourable areas for bird watching. The mouths of the larger rivers are likely to be key areas for sport fishing.

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## *6. IMPLICATIONS FOR DEVELOPMENT*

The results of the component studies clearly demonstrate that Lake Cabora Bassa and the Tchuma Tchato project area support important plant and bird biodiversity resources, and also valuable wilderness areas.

The ecological stratification reflects the fundamental divide between the valley and upland portions of the study area, the valley component being dominated by extensive mopane woodlands and the upland region by various types of miombo woodland. For both portions it is the less extensive vegetation types that are considered to be of greatest plant conservation interest. Most units, features, areas and regions identified as being of greatest plant biodiversity importance fall within the Zambezi valley, as do the important bird areas identified around the lakeshore and along the major rivers.

There is good coincidence between areas of biodiversity conservation interest and potential wilderness areas, most of which are similarly situated within the valley section and cover much the same areas: the western portions to either side of the lake, and the southeast region from Comboio through to the lower Luia drainage. These particular valley areas also represent the principal wildlife areas, in terms of both existing populations and additional areas of high wildlife potential (Davies, 1999; Mackie and Chafota, 1995; Tinley and Sousa Dias, 1973*). The maintenance of biodiversity and wilderness resources should be accepted as a legitimate planning and development goal for these principal broad regions of conservation and wilderness interest.*

The major threat to biodiversity and wilderness resources appears to be continued population expansion and associated growth of small scale rainfed agriculture. The introduction of cotton has been a major stimulant for agricultural expansion within the settled portions of the Zambezi Valley in Zimbabwe, and now appears to be spreading to the southern portion of the study area. Research from the adjacent part of Zimbabwe suggests that such rainfed cropping is unlikely to be sustainable, at least for the valley component of the study area (Cumming and Lynam, 1997).

There are different ways of responding to this threat. One option is to formulate policies that seek to regulate the rate of population expansion, for example by discouraging in-migration from elsewhere. However, the rationale behind the commissioning of this study was to avert such threats by proactive and pre-emptive developmental and land use planning that incorporates biodiversity and wilderness issues. Wildlife production and tourism appear to offer an alternative and more sustainable form of land use for the valley region (Cumming & Lynam, 1997). Furthermore, since large game species require relatively extensive tracts of natural habitat, these forms of production are more compatible with the maintenance of biodiversity and wilderness resources. Tourism, in particular, offers possibilities for increased income generation through the development of higher valued production options. *Such activities should be promoted, particularly for those regions identified as being of highest biodiversity and wilderness value.*

The combination of the lake, scenery and wildlife provide much the same mix of tourism features as for Lake Kariba, the major difference being that wildlife densities around Cabora Bassa are markedly lower than for Kariba. Field observations suggest that wildlife populations are coming under considerable pressure through poaching, throughout the area to the south of the lake. Although the Tchuma Tchato project has made great progress in terms of securing wildlife populations, this situation calls for continued effort and investment.

Access to the Cabora Bassa area is also considerably more difficult as compared to Kariba. The introduction of a ferry service linking Mozambique, Zambia and Zimbabwe would be a key improvement. This would make it possible to develop a new tourism circuit linking the study area with important wildlife areas in the adjacent

Zambezi Valley section of Zimbabwe and, in Zambia, along the Zambezi and Luangwa Rivers. This would create an important stimulus for tourism development throughout the larger region.

At a finer scale, there is a need to introduce a site-based conservation programme in order to secure the conservation of particular sites and features of greatest biodiversity interest such as the Luangwa colluvial fan, Comboio, the Gonono sand ridge and the Luia alluvium. The first step in such a programme would be to undertake a more detailed biological evaluation of individual sites of potential conservation interest, in order to make a more precise definition of the sites and their ranking in terms of conservation priority. This would need to be followed by a social evaluation that would provide the basis for the subsequent identification of potential conservation mechanisms. The Zambezi Society has developed considerable experience in this field, through implementation of precisely such a programme within the adjacent Muzarabani, Guruve and Mount Darwin Districts of Zimbabwe (Cunliffe, 1998).

Several sites and areas of high biodiversity and wilderness interest extend across the border into adjacent portions of Zimbabwe and Zambia. Successful management of these areas will require a high level of cooperation with neighbouring communities and states and the development of effective joint management approaches.

The development of a national park based on the Luia drainage to the southeast of the study area, has previously been recommended as a national priority (Tinley and Sousa Dias, 1973; Tinley et al, 1974). The results of this survey confirm that this is a key area for both biodiversity and wilderness conservation. However, an equally strong case could be developed for the western valley portions, both to the south of the lake, centred on the Angwa/Panyame Rivers, and to the north, including the valley portion between the Luangwa River and the escarpment. The designation of a national park in one of these areas could offer a valuable conservation mechanism, complementary to the continued promotion of community based natural resource management activities.

**The Lakeshore**

The lakeshore provides important bird habitat, particularly the restricted alluvial flats and sandbank areas. These are confined to the western end of the lake, in association with the larger rivers. The lake and lakeshore are also key tourism resources, the most important features being the spectacular gorge section, together with certain islands, peninsulas, river mouths and smaller inlets. From a plant biodiversity perspective, none of the lakeshore communities are particularly valuable, although certain representative portions are recommended for conservation status.

The main activities on the lake are kapenta fishing, which is concentrated to the east, and artisinal fishing which is carried out from small camps scattered all around the lake. The current intensity of development is not high, particularly on the north bank. However, the scattered nature of these developments, and the prospect of further unregulated expansion, appear to be the main threats to future wildlife and tourism opportunities.

There is a need to introduce some form of zoning for the lakeshore in order to ensure the optimum use of this key resource. This should specifically cater for the protection of key bird areas; wildlife and tourism areas; and fish breeding areas, whilst at the same time seeking to maximize benefits from continuing kapenta and inshore fishing operations.

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## *7. RECOMMENDATIONS*

Seventeen recommendations are put forward. These are divided into two sections, the first dealing with the implementation of the principal findings of the study, and the second with the collection of further technical information.

### A. IMPLEMENTATION OF FINDINGS

***i. Dissemination of findings:*** The results of this study should be widely disseminated amongst planners and developers, so as to facilitate the incorporation of the highlighted biodiversity and wilderness concerns into the planning and development process. A practical starting point might be to convene a workshop in Tete.

***ii. Promote biodiversity and wilderness conservation as planning goals:*** The maintenance of important biodiversity and wilderness resources should be accepted as a legitimate planning and development goal, particularly for the broad western and eastern valley regions of the study area that are identified as being of greatest biodiversity conservation and wilderness interest.

***iii. Site-based conservation programme:*** Efforts should be made to secure key biodiversity and wilderness areas through the initiation of a site-based conservation programme. This will require an examination of the sites and areas of interest in greater detail; placing them into some order of priority for conservation action; working with communities in order to identify potential conservation strategies for selected areas of highest conservation priority, and implementing them.

***iv. Promote tourism activities:*** Tourism activities should be promoted, on the basis of being an appropriate form of land use that is compatible with the maintenance of biodiversity and wilderness resources. Tourism should also lead to increased generation of revenues for the Tchuma Tchato project and participating communities.

***v. Build wildlife populations:*** Efforts to secure and build up wildlife populations in the valley portion should be continued and extended, in order to enhance both safari hunting and tourism opportunities.

***vi. Zambezi ferry:*** The introduction of a ferry service at the western end of the lake linking Mozambique to Zambia and Zimbabwe should be promoted, on the basis that this would act as a key stimulant for tourism development within the wider region.

***vii: Strengthen transborder collaboration:*** Current efforts to build and strengthen regional cooperation should be promoted, both at the intergovernmental level and between neighbouring communities, so as to enable the development of effective joint management initiatives for shared wildlife, biodiversity and wilderness resources.

***viii: Discourage in-migration:*** In-migration to the study area should be discouraged, in order to reduce the rate of expansion of rainfed cultivation, since this would appear to comprise the principal threat to biodiversity and wilderness resources.

And for the lakeshore:

***ix: Develop lakeshore zonation:*** A system of zonation for the lakeshore should be developed and implemented, in order to ensure optimum use of this key resource. In doing so, it would probably be useful to draw on experience from Lake Kariba.

***x. Protect key lakeshore areas:*** Protection should be introduced for key lakeshore areas identified under this study. This includes important tourism areas such as the gorge, islands and inlets, bird areas (alluvial flats

and sandbanks), areas important to the breeding of fish, and good representative areas of the principal vegetation types.

***xi: Monitoring:*** An integrated monitoring programme should be introduced that covers fisheries, fish populations, birds, aquatic weeds, and lakeshore settlement and development. The fisheries research vessel "Pende" would seem ideal for this.

**B. FURTHER TECHNICAL STUDIES**

The scarcity of biodiversity information for the Cabora Bassa region has been highlighted in the literature review. This study provides some further insights, but it also serves to emphasize the need for additional biodiversity surveys. The principal requirements are as follows:

***i: Extend studies to the area north of the lake:*** The vegetation and bird studies need to be completed for the portion to the north of the lake, in order to verify the proposed ecological classification and the identification of sites and areas of interest.

***ii: More detailed surveys of identified areas:*** Further more detailed survey work should be carried out concerning the sites and areas identified as being of greatest biodiversity conservation and wilderness interest. This should include key units, such as alluvial and colluvial types, as well as features and areas of interest. This will provide the basis for classifying sites into priorities for conservation action. Apart from improved biodiversity information, this will also require a better understanding of the existing pattern of settlement, and the identification of areas of likely future expansion, and thus threat, to priority areas.

***iii: Study herbaceous species:*** The existing vegetation sampling has concentrated on woody species. Provision should be made to incorporate herbaceous species in future studies. This will particularly be the case for the serpentine hills and northern dambo areas, which stand out as obvious priorities for further plant work.

***iv: Further bird surveys:*** Additional bird surveys need to be carried out during the hot-wet and hot-dry seasons. This will enable the development of a more comprehensive checklist of birds for the study area, and the better identification of important bird areas.

***v: Fish survey:*** A fish survey should be carried out for the lake in order to determine the types and abundances of fish species present; the identification of important fish breeding areas, and the species and areas most suitable for the promotion of sport fishing.

***vi: Further biodiversity studies:*** In general, many more biodiversity studies, particularly terrestrial, need to be done in order to obtain a clearer idea of the species are present, their conservation status and importance. Coupled with this, some of the earlier studies on changes in lake ecology need to be followed up. If, as has been suggested, the water release regime of the dam is to be changed to ameliorate the downstream effects of flood control on ecosystems, agriculture and fisheries, then attention should be paid to possible effects on the aquatic biodiversity of the lake and lakeshore.

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## *9. REFERENCES*


BFA, FFI & ZAMSOC. (1999). *Zambezi Basin Initiative for Biodiversity and Conservation: Outline Project Proposal, Pilot Phase.* Collaborative project by BFA/Fauna and Flora International/Zambezi Society, Bulawayo/UK/Harare.

Cumming, D.H.M. & Lynam, T.J.P. (1997). *Landuse Changes, Wildlife Conservation and Utilization, and the Sustainability of Agro-ecosystems in the Zambezi Valley. Final Technical Report - Volume I.* EU and WWF, Harare.

Cunliffe, R.N. (1996). *Sites of Interest for Botanical Conservation in the Communal Lands of the Zambezi Valley, Zimbabwe. Phase II - Initial Consultation Process.* BFA/Zambezi Society, Bulawayo/Harare.

Cunliffe, R.N. (1998). *Bits of Biodiversity: Conserving Sites of Botanical Interest with Particular Reference to Muzarabani District.* In: Proceedings of the Fifth Seminar of the Zambezi Society held at Mavuradonha Wilderness Camp, Muzarabani District, Northern Zimbabwe. Zambezi Society, Harare.

Davies, C. (1999). *Aerial survey of elephants and other large mammals in the Magoé District in north west Tete Province, Mozambique: 1999.* Multispecies Animal Production Systems Project Paper No. 74, WWF SARPO, Harare, Zimbabwe.

Joint Venture LI-EDF-KP. (1999). *Mepanda Uncua and Cahora Bassa North Project: feasibility study. Preliminary Environmental Impact Assessment*. Technical Unit for the Implementation of Hydropower Projects (UTIP), Maputo, Mozambique.

Mackie, C. & Chafota, J. (1995). *Aerial survey of large mammals in Magoé District (north west Tete Province) Moçambique: 1995.* Multispecies Animal Production Systems Project Paper No. 47, WWF SARPO, Harare, Zimbabwe.

Timberlake, J.R. (1996). *Sites of Interest for Botanical Conservation in the Communal Lands of the Zambezi Valley, Zimbabwe. Phase 1 - Identification and Prioritisation.* BFA/Zambezi Society, Bulawayo/Harare.

Timberlake, J.R. (1998). *Biodiversity of the Zambezi Basin wetlands. Phase 1 - Report for IUCN ROSA.* . BFA/Zambezi Society, Bulawayo/Harare.

Timberlake, J.R. [editor] (2000). *Biodiversity of the Zambezi Basin Wetlands. Phase II - Report for IUCN-ROSA*. 2 Volumes. BFA/Zambezi Society, Bulawayo/Harare.

Tinley, K.L. & Sousa Dias, A.H.G.d. (1973). Wildlife reconnaissance of the mid-Zambezi Valley in Moçambique before formation of the Cabora Bassa dam. *Veterinária Moçambicana* **6**(2): 103-131.

Tinley, K.L., Roshina, A.J., Lobao Tello, J.L.P. & Dutton D.P. (1974). Wildlife and wild places in Mozambique. *Oryx* 13: 344-350.

Wynn, S. (2000). *The Zambezi River: Wilderness and Tourism.* The Zambezi Society, Harare.