

**Biodiversity surveys in the Misotshi-Kabogo and Marungu  
Regions of eastern Democratic Republic of Congo,  
with a focus on chimpanzees**



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## **EXECUTIVE SUMMARY:**

The Misotshi-Kabogo region and the Marungu Massif of eastern Democratic Republic of Congo (DRC), formerly called Mt Kabobo, has not been visited by any survey team since the late 1950s. As a result of rebel activity the Misotshi-Kabogo region has been impossible to visit for over 50 years and it is only recently that a survey such as the one described here has become feasible. The Wildlife Conservation Society led a team of researchers from the WCS Uganda and DRC, The Field Museum in Chicago, ICCN and WWF to survey this large forest block that was known to occur on the escarpment above Lake Tanganyika north of the town of Kalemie. This forest was visible from satellite imagery and is nearly 1000 km<sup>2</sup> in size. The focus of the surveys was on chimpanzees but the opportunity was also made to collect data on other species and human impacts because of the long time period since this forest had last been visited by any scientist.

Initial aerial surveys were made of the two regions and it was soon obvious that the Marungu Massif had been almost totally converted to pastureland and agriculture. There was nowhere that was worth surveying left that we could find. However, to the north of Marungu was a large area of Miombo woodland and riverine forest around the Muganja Hills. The aerial survey showed the Misotshi-Kabogo region to be very promising. As a result field teams surveyed this area and the Muganja Hills area.

The findings of the surveys are summarized here and provide estimates of chimpanzee numbers and distribution, large and small mammals that can be found in the forest, birds, frogs and reptiles and plant species. These findings show that the Misotshi-Kabogo Forest and the region of gallery forest and woodland around it is extremely rich in species, and contains many endemic species. Four mammal species were discovered that were new to science and an additional two frog species are new. Plant specimens have yet to be completely identified but around 10% of the specimens may need to be shipped to experts because local botanists cannot identify them.

Human impacts have been relatively minor, artisanal gold mining being the most threatening to the biodiversity of the forest. Most of the gold mining is carried out by migrants from Bukavu and Uvira as the local people do not feel that they can obtain enough from the mining to make it worth their while. Consequently the returns on the mining are minimal. It would be relatively easy to stop the mining if any protected area were created in the region. Many of the village chiefs and elders in the villages we visited thought that creating a protected area would be a positive step for their region, bringing a focus to their region and possible development impacts also as a result. There is certainly a potential for tourism in the Misotshi-Kabogo region although access to the forest is hard.

We believe that conservation of the Misotshi-Kabogo region is important and that some form of conservation area should be gazetted. This should be done in collaboration with the local communities who live in the area to minimize any conflict and to look at ways they could benefit from the creation of such an area.

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## CHAPTER 1. The Misotshi-Kabogo and Marungu regions

A.J.Plumtre and D.Kujirakwinja

### Introduction

The Albertine Rift region of Africa has been identified as an Ecoregion, Endemic Bird Area and is part of the Eastern Afromontane Biodiversity Hotspot (Plumtre et al., 2007). Six major landscapes in the Albertine Rift have been identified as part of a strategic planning process for the conservation of the biodiversity of this highly species rich region of Africa (Plumtre et al., 2007). The Marungu Massif and the region around an area that has historically been called Mt Kabobo in the Democratic Republic of Congo (DRC), south and north of the town of Kalemie respectively, formed part of the 6<sup>th</sup> landscape (figure 1). However, this region is the least known of all the landscapes having been difficult to access for many years because of civil strife in the DRC. Mt Kabobo appears to have been poorly named (see section on history and nomenclature below) but we use the name here when referring to this region as it would have been referred to in the literature but use the proposed name Misotshi-Kabogo in the rest of the report.

The Marungu Massif occurs in the south east corner of the DRC on the shore of Lake Tanganyika. Although poorly surveyed to date, it has one of the earliest records of chimpanzees (Thompson, 1997; 2003). A recent taxonomic revision of chimpanzees by Colin Groves split the eastern chimpanzee (*Pan troglodytes schweinfurthii*) into two. This subspecies is now recognised as occurring in northern DRC across to the Ituri region. Chimpanzees found further south in DRC and east in Uganda, Rwanda, Burundi and Tanzania have been named *P.t.marungensis* after the first skeletal material from this region. This poorly known population of chimpanzees is the only one known of south of the Congo River and its tributaries in DRC, as the river separates chimpanzees from Bonobos (*Pan pansicus*). This population either came around the southern end of lake Tanganyika from Tanzania during a wetter period when forest cover would have been greater or they must have crossed the Lukuga river, that leaves Lake Tanganyika at Kalemie and joins the Congo River west of the town, at some point when it dried in the past. Since the collection of skeletal material in the early 1900s there has been little work on these chimpanzees or in this region.

Mount Kabobo to the north of the Marungu highlands was another region which had been poorly surveyed and it wasn't known if it contained chimpanzees. This was a potentially interesting massif which has been separated from the Itombwe Massif to the north by the Kilombwe River, which formed a valley about 10 km wide, which is thought to have existed for about 10,000 years. This region has been identified as an important bird area (Fishpool and Evans, 2001) because of the endemic Kabobo Apalis which is only found in this region.

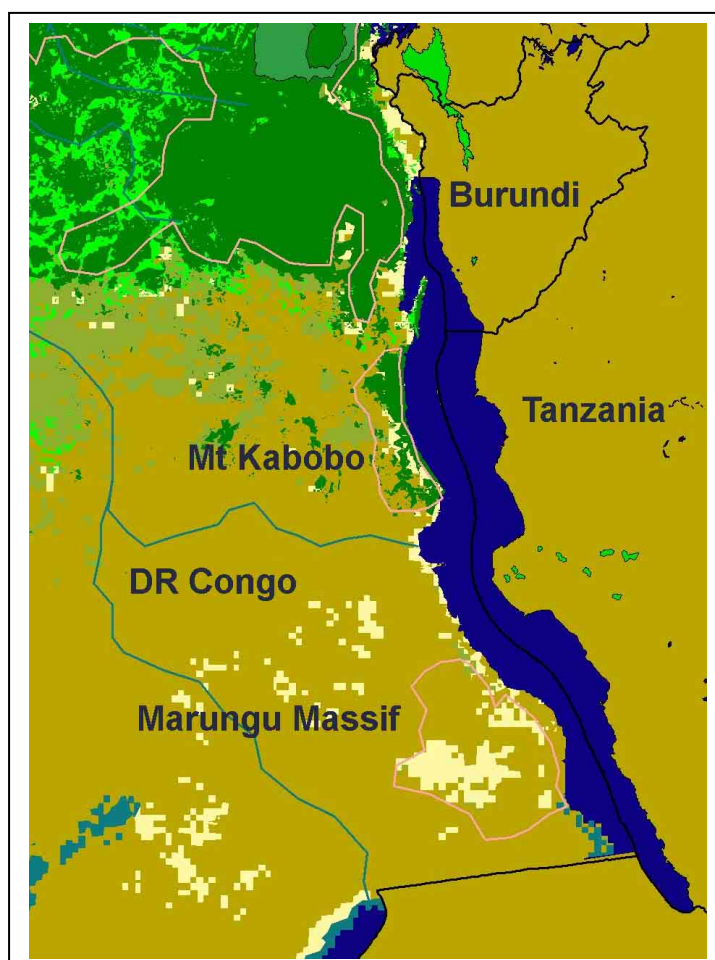
Both of these highlands were potentially important for the conservation of other species also and were known to contain species endemic to the Albertine Rift Ecoregion. However the last surveys of any biodiversity had been made in the 1950s and little was known about the current state of these two areas.

The Wildlife Conservation Society (WCS) has been undertaking surveys of all the forested sites in the Albertine Rift and wanted to visit this region because of its potential importance for conservation and because little was known about the sites. WCS put together a team with the Field Museum of Chicago, Lwiro Research Centre, Bukavu and the World Wide Fund for Nature East Africa Regional Program Office to undertake surveys of this landscape in 2006/2007.

### **Goals and Objectives**

The overall goal of the project was to assess the conservation value of the Marungu Highlands and Mt Kabobo, with particular emphasis on the chimpanzee, *P.t.marunguensis*. Three specific objectives were identified:

1. To undertake an aerial survey of the Marungu Highlands and Mt. Kabobo to identify access routes, potential sites with chimpanzees and key villages and towns.
2. Survey chimpanzee populations in the Marungu highlands to estimate a density and potential population size. Assess whether chimpanzees occur in Mt Kabobo and if so survey this population also.
3. Survey other biodiversity to assess the importance of the two regions for conservation.

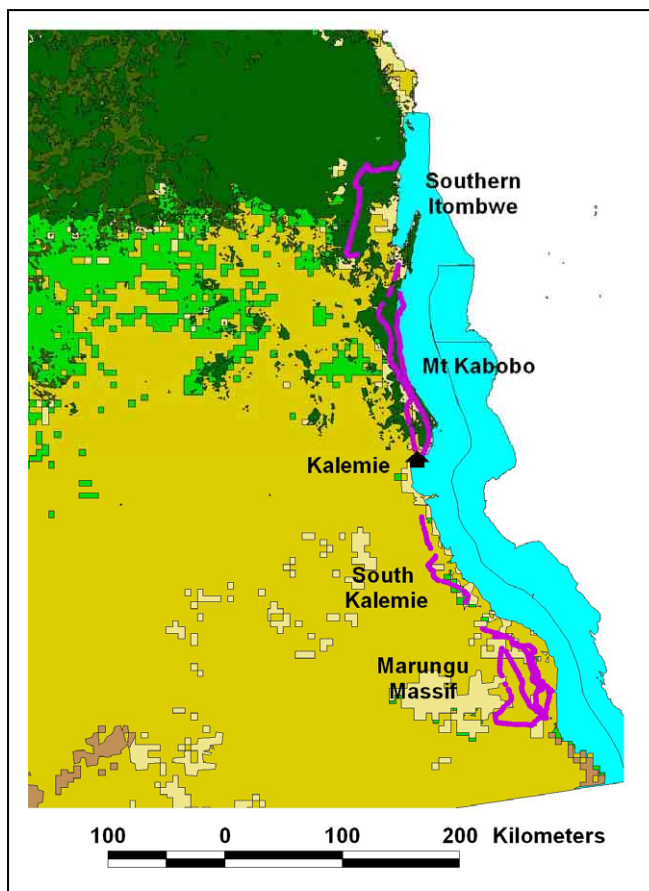


**Figure 1.1.** Map of the region west of Lake Tanganyika showing the location of the Marungu Massif and Mt Kabobo.

### **Aerial Reconnaissance**

In June 2006 an aerial reconnaissance was made of the region and a visit made to Kalemie, the regional administrative centre, to make contacts with relevant officials and discuss the necessary logistics that would be needed to undertake the surveys. The flight commenced from Goma with three observers, Dr Andrew Plumptre (WCS Albertine Rift Program), Deo Kujirakwinja (WCS Goma) and David Moyer (WCS Flight Program) and headed over the mountain sector of Kahuzi Biega National Park, skirted the Itombwe massif and went down over Mt Kabobo to Kalemie. The next day

the Marungu Massif was surveyed and also the region south of Kalemie and north of Marungu. On the third day the lake shore and the edge of the Mt Kabobo region was surveyed on route back to Goma (figure 2).



**Figure 1.2.** Map showing the flight paths (purple lines) taken over Mt Kabobo and Marungu Massif.

#### *Marungu Massif*

While made over a short time period this survey was incredibly useful. In particular we were able to determine that the Marungu Massif had lost most of the natural habitat as a result of human activity (Photo 1). It became very clear after flying around much of the massif that most natural habitat had been converted to farmland, either for cattle (grassland areas) or for crops (forested areas). While we had known that this region was an area where Belgians had settled to farm cattle in the past we had hoped to find pockets of forest where chimpanzees might still be present. However there was nothing we could find that looked like it might be worth surveying.



**Photo 1.** A typical view of the landscape on the Marungu Massif. Where forest used to occur in galleries it is being cultivated and elsewhere most of the grassland has been converted to pasture land.



As a result of the survey over Marungu Massif we also searched a bit more intently in the area south of Kalemie and south of the Lukuga river which becomes the Congo River downstream. This region did show some areas of relatively intact natural habitat which we decided to survey. Interviews with people in Kalemie also indicated that chimpanzees might still be found in this region. So we believed that there were still chimpanzees south of the river but that it was highly unlikely that any remained on the Marungu Massif itself. As a result we decided to survey an area called the Muganja hills to the north of the Marungu Massif.

#### *Mt Kabobo*

It was very clear from the aerial survey that Mount Kabobo was much more interesting and could potentially be an important site for conservation. The forest is relatively large and intact (Photo 2a) and stretches over about 100 km along the escarpment above lake Tanganyika (figure 1). It is much larger than the forest in Mahale Mountains National Park in Tanzania and as a result it is the largest block of forest on Lake Tanganyika. The only sign of human settlement was a few fishing villages on the lake shore although there was evidence of mining in the forest on the escarpment above the villages. West of the forest there was little sign of human presence (Photo 2b). Of particular interest was the fact that forest exists down to the lake shore at several sites along the lake and therefore ranges in altitude between about 770 and 2,750 metres. There are few places in the Albertine Rift where you can still find continuous forest that spans this elevation range.



**Photo 2.** Aerial photos of Kabobo forest. a) Left shows the view east across the forest looking towards the escarpment above lake Tanganyika. b) Right shows the view west towards the Congo river showing the gallery forest and savanna.

#### **Some notes on the history of the Kabobo/Misotshi-Kabogo forest and nomenclature**

The forest on the escarpment above lake Tanganyika stretches over 100 km from about 30 km north of Kalemie up to the peninsula that projects into Lake Tanganyika (figure 1). It varies in width but most of the forest is between 10-20 km wide. The first peoples to inhabit this region were the Baoloolo, a people closely related to the pygmies of the Congo forest basin. The Babembe people moved into this region and displaced them several hundred years prior to colonisation. The Babembe claim to have governed all the region of South Kivu down to Kalemie but just prior to Belgian colonisation of DRC they were pushed back by several tribes (particularly the Baluba) to the current border between Katanga and South Kivu (just north of Mt Kabobo) which is why the boundary was fixed at this point. However most of the names of the region are Babembe names. When DRC gained independence from

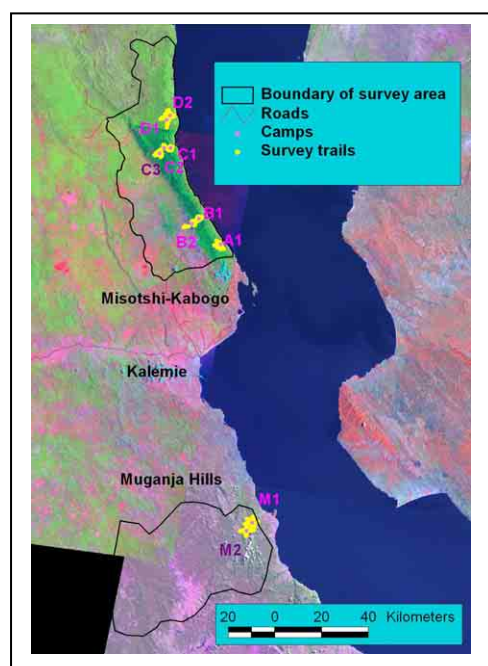
Belgium in 1960 Patrice Lumumba, the first President, was assassinated soon after gaining power, with involvement of the Belgian Government and CIA. President Mobutu Sese Seko replaced him and proceeded to govern the country up to 1996. Almost immediately rebel groups loyal to Lumumba established themselves in the east of the DRC to try to regain control. Laurent Desire Kabila established one such group in South Kivu and he resisted Mobutu for 20 years, hiding out much of the time in the forest on the escarpment above lake Tanganyika, where he mined gold to fund his rebel activities. He came to prominence in 1975 when he kidnapped two American Researchers from the Gombe Field Station in Tanzania, Jane Goodall's field site, and ransomed them. In 1980 Mobutu drove Kabila with a large military attack on the forest (bullet cases can still be found strewn across the hillsides). Although he succeeded in driving Kabila to Tanzania, there were always pockets of resistance in the forest which made it insecure. However Kabila continued to work towards his goal of liberating DRC from Mobutu. Kabila came to power and became President in 1996 with support from Rwandan and Ugandan forces who overthrew Mobutu, forcing him into exile where he died of prostate cancer. Laurent Kabila was assassinated in 2001 and replaced by his son Joseph Kabila.

Some biological surveys were made of the Kabobo region in the 1950s. Prigogine sent a field team to collect bird specimens in 1954, 55 and 57 (Prigogine, 1960). Laurent also collected amphibians in the forest (Laurent, 1952). Specimens were sent to the Africa Museum at Tervuren in Belgium. The bird surveys concentrated their efforts primarily around a hill top that was called Kabobo by the Belgians. They discovered that there was an endemic species of *Apalis*, which was called the Kabobo *Apalis* (*Apalis kaboboensis*). The surveys we made however throw into question the nomenclature of this region. According to the Babembe the Belgians misheard the name Kabobo. There is a river and region near the source of this river called Kabogo after a spirit (Kabogo means 'power' in the Babembe language) that is believed to inhabit the river. It is said to manifest itself as a ghostly boat that appears occasionally on lake Tanganyika at night, guaranteeing good fishing if fishermen sight it. The hill which was named Kabobo by the Belgians is near the source of this river but is by no means the highest peak (2,650 metres). There is a higher peak (2,725m) which is locally called "Antenne" because it used to be the site of a large radio mast which was constructed by the Belgians but which has long disappeared. However, according to Babembe culture the most important peak in the chain along the lake is Misotshi, named after the most powerful spirit believed to inhabit the mountains. Nobody climbs this mountain without permission and ceremonies are held by the Babembe where they 'enter a door' in the hill side (probably a cave) to undertake the ceremony. Our surveys required both permission from the local chiefs and an escort of two of the chief's men to climb part of this mountain but we were unable to reach the peak. The belief in this spirit also extends to the Tanzania coast of Lake Tanganyika where any spirit worship of the spirit that inhabits Mt Kungwe in Mahale Mountains National Park requires authorisation from the regional chief and Shaman who consult Misotshi before giving permission for a ceremony to proceed. It is clear that under Babembe culture Misotshi is therefore the most important peak in the chain of peaks. We asked the local chiefs which would be the most appropriate name to give to the forest that is found along the escarpment and it became obvious that they have no name for the whole area; individual hills and rivers have names but not the whole forest. They suggested 'Misotshi-Kabogo' forest as a name but this should be discussed amongst all the regional chiefs. We therefore use this name throughout the rest of the report instead of Mt Kabobo. Interestingly there are several Taboos associated with the spirit Misotshi which include a taboo against the killing of chimpanzees in the forest and also a taboo against destroying the forest.

## Fieldwork

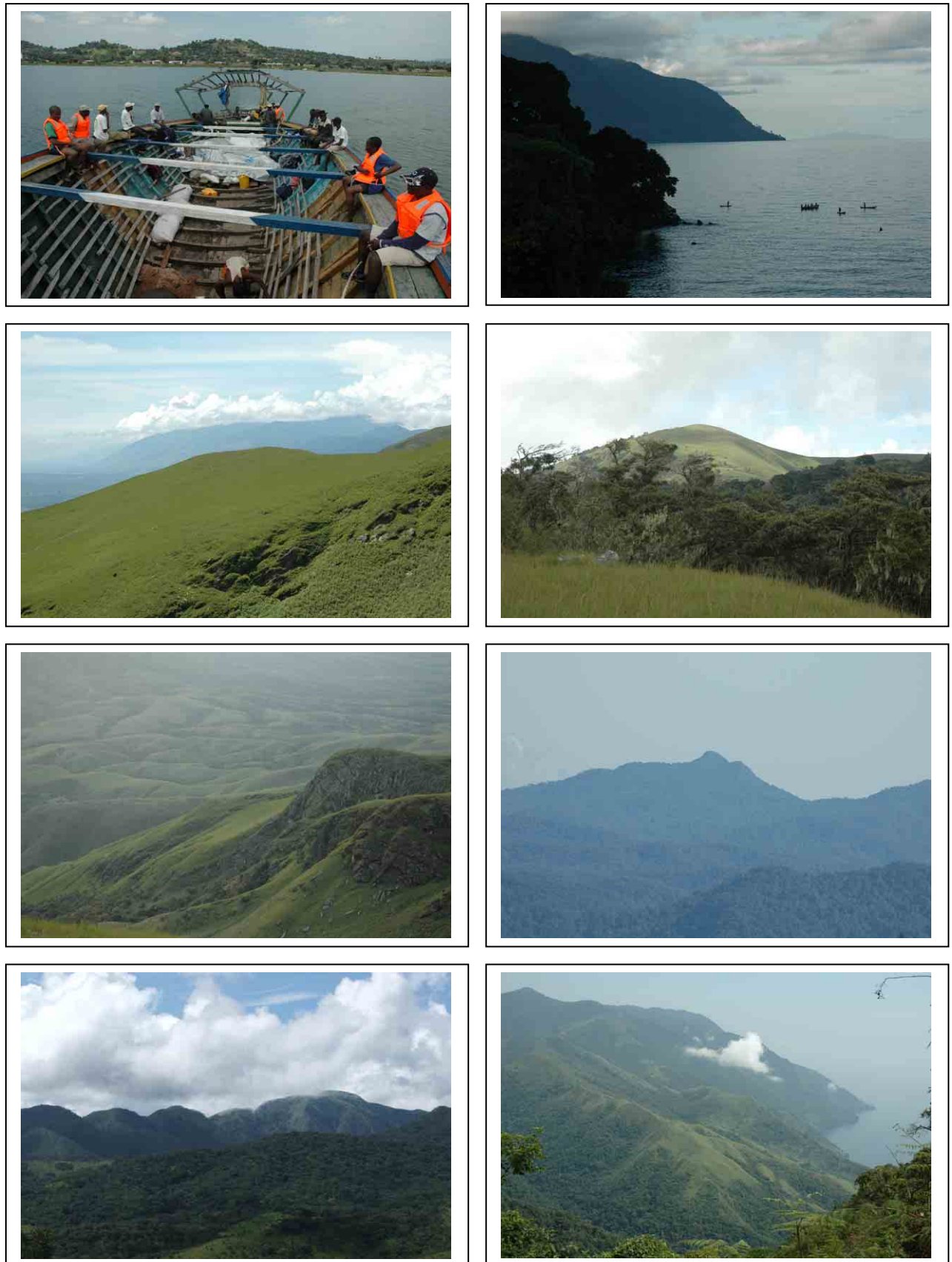
Two field teams were formed to survey large mammals, birds, plants and human impacts at each site we visited in the forest. In addition we had one team looking at small mammals, another at reptiles and amphibians and a third collecting butterflies for identification. Researchers from the Field Museum in Chicago also collected bird and small mammal specimens for identification and comparison with other areas in the Albertine Rift. Deo Kujirakwinja went to Kalemie ten days in advance of the rest of the field team to sort out the logistics of transporting the teams in early January 2007. As the road infrastructure had deteriorated over the period of the war in DRC we had decided to access the forest from the lake side, using fishing boats to transport the field teams. This also allowed us to access areas that had never been surveyed by scientists before. The teams met in Goma where some explanation of the logistics were made and then were flown to Kalemie. Here we spent 3-4 days sorting out logistics and covering all the field survey methods in detail. Teams were then transported up the lake and the two teams dropped at different fishing villages where they could hire porters to access the forest. After about two weeks the teams returned to the village and were collected and transported further up the lake to two further villages where we spent nearly three weeks. The team with the small mammal and bird trapping equipment was less mobile because of the amount of equipment and they established three camp sites, one from their first village and two from their second village. The other team however was able to visit two sites from their first village and a further three from the second. This enabled the team to cross the escarpment and descend some of the western side of the massif. The surveys of Misotshi-Kabogo took place between 28<sup>th</sup> January and 26<sup>th</sup> February 2007.

After finishing at the second villages many members of the teams continued north up the lake to Uvira and then by taxi to Bukavu and boat to Goma across lake Kivu. A smaller team returned to Kalemie to survey the region between Kalemie and the Marungu Massif where we had identified some natural vegetation which might contain chimpanzees. This region, the Muganja hills, was surveyed for large mammals and birds as well as human impacts. These surveys took place between 4<sup>th</sup> and 18<sup>th</sup> March 2007. Details about the methods used in each of the surveys are given in the respective chapters that follow.



The areas surveyed are mapped in figure 1.3. A larger area was measured for forest cover at the two sites (Misotshi-Kabogo and Muganja Hills) and densities of chimpanzee nests extrapolated to these two areas.

**Figure 1.3.** Satellite image of Lake Tanganyika showing areas surveyed (yellow) and boundary of areas for which forest cover was calculated (black lines). Camp labels (A1, B1, B2 etc) are shown in pink.



**Photo 3.** Clockwise from top left. a) boat used to transport field teams and equipment, b) escarpment down to lake Tanganyika, c) Mt Kabogo, d) Mt Misotshi from the west, e) forest view below Kabogo, f) woodland in Muganja region south of Kalemie g) view down escarpment on western side of Kabogo, h) view towards Kabogo showing western side of escarpment.



## CHAPTER 2: Chimpanzee and Other Large Mammal Surveys

A.J.Plumptre, D.Kujirakwinja, A. Baruti, and N.Mutungire

### Introduction

The Misotshi-Kabogo region is known to contain some interesting species of large mammals from previous survey work there. Prigogine (1960) records 17 species including the endemic subspecies of Angolan Colobus (*Colobus angolensis progoginei*) that is only known from the Misotshi-Kabogo region. Distinguished from other subspecies by its completely white tail it was a species we were particularly interested in finding more about. He also recorded Bongo (*Tragelaphus euryceros*) and we were interested to ascertain if this species still existed in the forest.



### Methods

We used a combination of methods to ascertain which large mammal species occur in the Misotshi-Kabogo forest. We worked with hunters in the forest as well as two soldiers who had fought with Kabila in the 1970s and later. These people were interviewed about which large mammal species they had seen in the forest and where they saw them. We used Kingdon's guide to Large Mammals of Africa to show these people pictures of the animals and then cross checked their identifications by asking them about the behaviour of the animal. We also asked people in villages to show us any skins of animals to cross check the list obtained by talking to hunters. This process provided us a list of mammals known from the area. However, we also attempted to collect quantitative data on large mammals where we surveyed as follows:

### Training

The field surveys commenced in January 2007. Training of the two mammal survey teams was made in Kalemie. Field data collection methods included training in the use of:

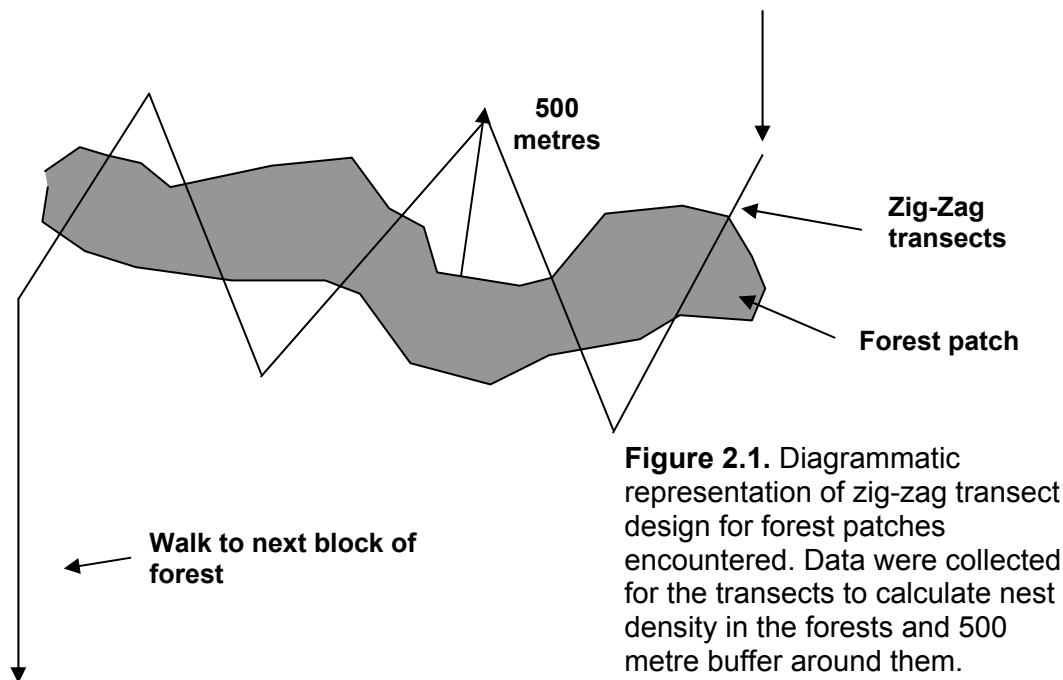
1. Hip chain and topofil thread to measure distance traveled
2. Range finders to measure perpendicular distances when these were greater than 30 metres (30 metre tape measures were provided to each team).
3. Use of GPS units. Garmin II Plus and 12 XL units were used to collect positional data.
4. Completion of data sheets

### Sampling methods

Teams were also trained in how to sample the forest when they were in the field situation. It was decided to focus transect effort on the forest areas because of the need for chimpanzees to be associated with this vegetation type. Data on gallery forest sampling was separated from the data from the main Misotshi-Kabogo forest block.

In gallery forest we used a sampling method that we had used in western Tanzania in 2005. Transects were walked in fixed compass directions from the camp site. Where only gallery forest existed zig-zag transects were walked to maximize the time spent in this forest type before moving towards the next patch of forest. These zig zag transects extended beyond the forest by 500 metres before returning back to the forest. In this way some sampling was made in the woodlands around the gallery forests but most of the effort was concentrated in the forests (fig. 2.1). Densities

could be calculated for forest and the surrounding 500 metres of woodland from these data and a satellite image analysis was made that enabled us to measure the area of forest with this 500 metre buffer in the study region. Once a patch of forest had been surveyed with the zig-zag transects a walk was made following a fixed compass direction to the next patch of forest. Data were collected on these walks also and analysed to obtain estimates of nest density in woodland within 2 km of forest separately.



At each camp site a transect or reconnaissance walk was made each day following a compass direction where possible but deviating when the terrain became impassable or if in gallery forest. Much of the Misotshi-Kabogo forest consists of very steep hillsides which have been cut by fast running rivers. Many of the rivers have cliffs along their course making traversing them very difficult. We therefore used reconnaissance walk methods whenever we reached a point that was impassable and then selected a new compass direction.

GPS positions were taken for any sighting of an animal or its signs (nest or dung of elephant, buffalo and pigs) and also every 250 metres a GPS position was taken with a description of the habitat type. This allowed us to map where teams had visited and also helped ground truth the satellite classifications.

### ***Censusing chimpanzees***

Chimpanzees are difficult to census directly because they tend to be shy and secretive and are often missed when walking through forest. They are also rare and live at low densities and so are not often encountered either. However, they make nests in which they sleep and we can use these nests to obtain an index of the population and with correction factors we can estimate the densities of chimpanzees (Plumptre and Reynolds, 1996, 1997; Plumptre, Cox and Mugume, 2002; Plumptre and Cox 2005). Each field team counted chimpanzee nests along the transects walked and measured the perpendicular distance between the centre of the nest and the transect. Where groups of nests occurred together, each individual nest was measured separately (Plumptre and Cox, 2005). In order to correct nest density to obtain an estimate of chimpanzee density we needed to correct for the production

rate of nests and the decay rate of nests. Only one study has measured the production rate of nests in wild chimpanzees which incorporated the construction of nests during the day as well as at night and the reuse of nests (Plumptre and Reynolds, 1997) and therefore we borrowed the value of 1.1 nests per day per nesting individual from this study. It was not possible to measure nest decay rates in this study because of the difficulty of keeping a team of people on site for long enough. We therefore opted to use a decay rate that had been measured for Mahale Mountains National Park across the lake in western Tanzania. Nest decay rates had been calculated by Ihobe for Mahale Mountains National Park (Ihobe, 2005).

Nests sighted on transects were assigned age classifications as follows:

- 1= Fresh:** Leaves in cup of nest all green and cup solid
- 2= Dry:** Leaves going brown (possibly some green) but nest cup still pretty much intact
- 3= Old:** Nest cup disintegrating – most leaves lost and can mainly see gaps between leaves in cup
- 4= Decayed:** No leaves left (less than 5%) – twigs left only.

Ihobe (2005) recorded a decay time of 131 days but his definition of point of decay included nests without leaves. If he used the same definition as we did above, his average time to decay was 49 days, a little longer than the decay rate of nests in Budongo Forest in Uganda (45 days – Plumptre & Reynolds, 1996).

## **Data analyses**

### ***Chimpanzee densities***

Chimpanzee nest density was calculated using standard perpendicular distance techniques and the computer software DISTANCE (Buckland *et al.* 1993). Densities were calculated separately for the main forest block of Misotshi-Kabogo and for gallery forest/woodland.

Woods Hole Research Center are in the process of calculating the area of forest (block and gallery) in the region in and around the Misotshi-Kabogo area and which could potentially be protected in future from satellite imagery. They are also calculating the area of forest/woodland in the Muganja hills region. However because of the need to report on the work so far and move forward with the findings we have used estimates of forest cover from existing land cover data sets; particularly a biomass map produced to map woody biomass in Africa. Densities of chimpanzees were multiplied by forest area to obtain an estimate of total chimpanzee numbers in these two areas.

## Results

### *Large mammal species known to occur in Misotshi-Kabogo*

Interviews with local hunters and an assessment of skins and parts of hunted animals that villagers produced for us helped us to produce a list of 50 large and medium sized mammals for the Misotshi-Kabogo forest and surrounding area of gallery forest and savanna grasslands (Table 2.1). We recorded those species we definitely confirmed as being present from sightings, skins, dung or skulls and also recorded Babembe names for the species as this helped us separate which animals were likely to be different species. We also tried to cross check identifications between hunters and query a species if only one hunter reported it (Table 2.1).

**Table 2.1.** List of large and medium mammals that we are fairly certain occur in the Misotshi-Kabogo region. Where we found certain evidence of the species (sighting, dung, skins, skulls) we have indicated in the table under 'confirmed'. The Babembe names are also given. Where we only had one hunter report the species it is noted.

| Common name           | Latin name                           | Confirmed | Babembe Name       |
|-----------------------|--------------------------------------|-----------|--------------------|
| Angolan Colobus       | <i>Colobus angolensis prigoginei</i> | 1         | Eungu              |
| Red Colobus           | <i>Ptilocolobus oustaleti foai</i>   | 1         | Alokiyo            |
| L'hoests guenon       | <i>Cercopithecus lhoesti</i>         | 1         | Mbise              |
| Blue monkey           | <i>Cercopithecus mitis</i>           | 1         | Ema                |
| Redtail monkey        | <i>Cercopithecus ascanius</i>        | 1         | Assonga            |
| Dent's Monkey         | <i>Cercopithecus denti</i>           | 1         | Lubukyu            |
| Vervet monkey         | <i>Cercopithecus aethiops</i>        |           | Ende               |
| Grey-cheeked Mangabey | <i>Lophocebus albigena</i>           | 1         | Ejogojogo          |
| Owl-faced monkey?     | <i>Cercopithecus hamlyni</i>         |           | Only one hunter    |
| Baboon                | <i>Papio anubis</i>                  | 1         | Amba               |
| Chimpanzee            | <i>Pan troglodytes</i>               | 1         | Soho               |
| Bush pig              | <i>Potamo</i>                        | 1         | Ngulube            |
| Giant Forest Hog      | <i>Hylochoerus meinertzhageni</i>    | 1         | Senge              |
| Bushbuck              | <i>Tragelaphus scriptus</i>          | 1         | Ulungu             |
| Bongo                 | <i>Tragelaphus euryceros</i>         | 1         | Mangala            |
| Red duiker (Weyns?)   | <i>Cephalophus (weynsi)</i>          |           | M'mbale wa Bishilu |
| Black-fronted duiker  | <i>Cephalophus nigrifrons</i>        | 1         | M'mbale wa Pombo   |
| Yellow-backed duiker  | <i>Cephalophus</i>                   |           | Tundu              |
| Blue duiker           | <i>Cephalophus monticola</i>         | 1         | Abuluku            |
| Bush duiker           | <i>Sylvicapra grimmia</i>            |           | Swala              |
| Klipspringer          | <i>Oreotragus oreotragus</i>         |           | Ehala              |
| Buffalo               | <i>Syncerus caffer</i>               |           | Mboko              |
| Elephant              | <i>Loxodonta africana</i>            |           |                    |
| Sitatunga?            | <i>Tragelaphus spekei</i>            |           | Nzogu              |
| Lion                  | <i>Panthera leo</i>                  |           | Tambwe             |
| Leopard               | <i>Panthera pardus</i>               |           | Hangwe             |
| Golden cat            | <i>Felis aurata</i>                  | 1         |                    |
| Serval                | <i>Felis serval</i>                  | 1         | M'bwabwa           |
| Spotted Hyaena        | <i>Crocuta crocuta</i>               |           | Mlunga             |
| Side-striped Jackal   | <i>Canis adustus</i>                 | 1         | Elundu             |
| African Wild Dog?     | <i>Lycaon pictus</i>                 |           | Ngalabi            |
| Common genet          | <i>Genetta genetta</i>               | 1         | Mshimba            |
| Blotched genet        | <i>Genetta tigrina</i>               | 1         |                    |
| Ratal                 | <i>Mellivora capensis</i>            |           | Seele              |
| Marsh Mongoose        | <i>Atilax paludinosus</i>            |           | Mimala             |
| Banded Mongoose       | <i>Mungos mungo</i>                  | 1         |                    |
| Slender Mongoose      | <i>Herpestes sanguinea</i>           | 1         |                    |
| African Palm civet    | <i>Nandinia binotata</i>             | 1         | Abulubulu          |



|                          |                                  |   |                 |
|--------------------------|----------------------------------|---|-----------------|
| Spot-necked Otter        | <i>Lutra maculicollis</i>        |   | Eôha            |
| Giant Pangolin           | <i>Smutsia gigantea</i>          | 1 | Aa              |
| Tree Pangolin            | <i>Phataginus tricuspis</i>      | 1 | Abanga          |
| Brush-tailed Porcupine   | <i>Atherurus africanus</i>       | 1 | Esese           |
| Crested Porcupine        | <i>Hystrix cristata</i>          |   | Fumba           |
| Marsh Cane Rat           | <i>Thryonomys swinderianus</i>   |   | Simbiliki       |
| Red-legged Sun Squirrel  | <i>Heliosciurus rufobrachium</i> | 1 | Esende          |
| Carruther's Sun Squirrel | <i>Funisciurus carruthersi</i>   | 1 | Akese           |
| Lord Derby's Anomalure   | <i>Anomalurus derbianus</i>      |   | Membe Luuto     |
| Chequered Elephant Shrew | <i>Rhynchocyon cirnei</i>        |   | Lunda Lunda     |
| Giant Otter Shrew?       | <i>Potamogale velox</i>          |   | Only one hunter |
| Western Tree Hyrax       | <i>Dendrohyrax dorsalis</i>      | 1 | Mbela           |

Elephants and buffalos have not been observed recently by most hunters but there are occasional reports that come back to the villages that make people believe some still occur in the forest. They may also be found west of the Misotshi-Kabogo massif in the savannas and gallery forest which is little visited by people from the fishing villages on Lake Tanganyika. This is also where wild dog, lions and hyaenas might be found. Interestingly nobody recognized any bushbabies, or potto or African civet, which are all species that might be expected to occur there.

#### **Encounter rates of large mammals from transects/reconnaissance walks**

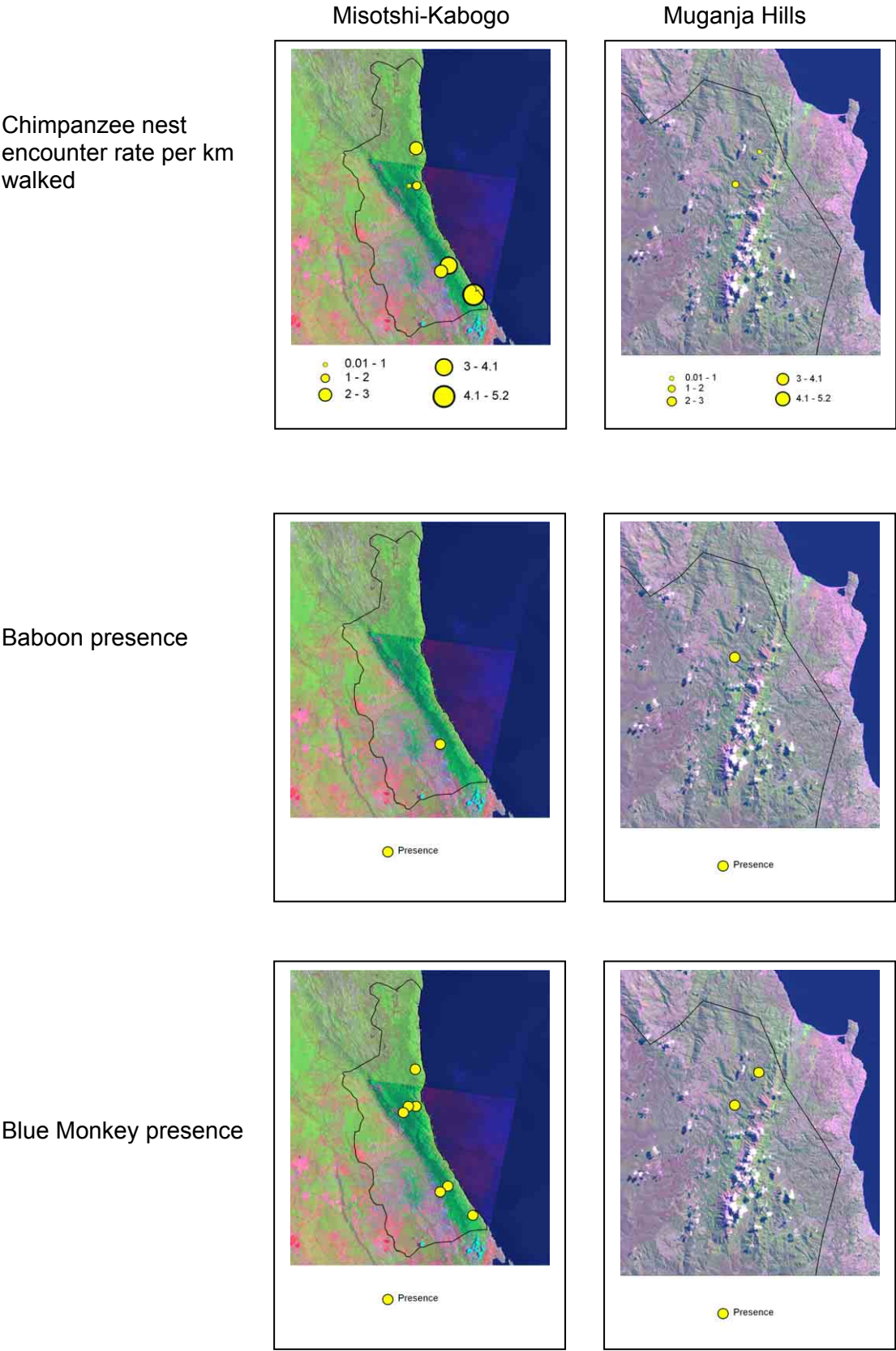
Sightings of mammals from transects and reconnaissance walks were few. It became clear that hunting of mammals with snares and guns had reduced their populations and caused them to be very fearful of people. When sighted they would flee silently, even those species that normally give alarm calls elsewhere in the Albertine Rift such as the guenons. Consequently for most species we recorded presence/absence at each camp in the forest rather than abundance. Chimpanzee nests were relatively abundant, however, partly because the Babembe have a taboo against killing them and also because nests can remain some time before decaying.

A total of 178 chimpanzee nests were observed on 133.40 km of transect/reconnaissance walk over the whole study. Of this distance walked, 73.24 km was in the main Misotshi-Kabogo forest block (below 2,200 metres), 15.48 km above 2,200 metres altitude and 44.68 km in gallery forest. The density of chimpanzee nests varied between the main forest block and gallery forest (Table 2.2) but these differences were not significant when tested ( $Z=0.80$ ,  $P>0.05$ ).

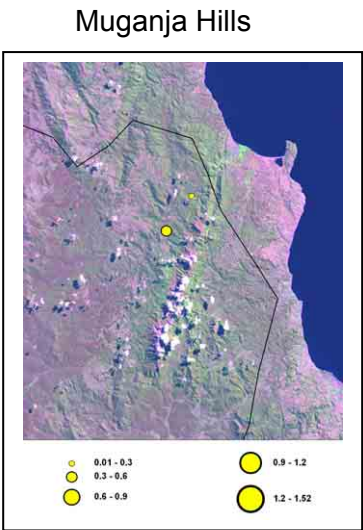
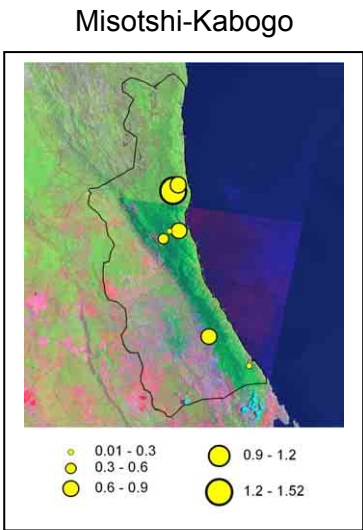
**Table 2.2.** The density of chimpanzee nests in the two forest types and the density with combined data.

| Forest type    | Density (no. km <sup>-2</sup> ) | Standard error | 95% limits | Number of nests |
|----------------|---------------------------------|----------------|------------|-----------------|
| Forest Block   | 65.5                            | 16.9           | 39.0-109.8 | 134             |
| Gallery Forest | 38.7                            | 27.9           | 9.2-161.5  | 44              |
| All Forest     | 51.3                            | 13.5           | 30.4-86.4  | 178             |

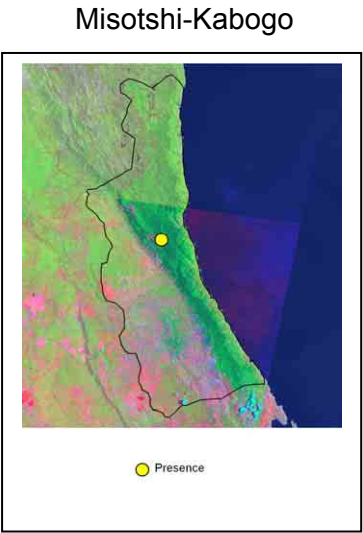
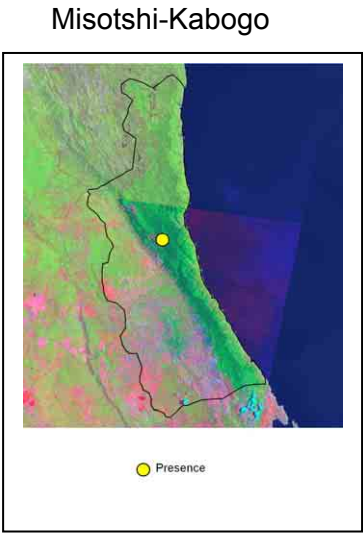
Figure 2.2 summarises the relative abundance of chimpanzees (from nest encounter rates), bushpigs (from dung) and presence/absence of other primates and large mammals.



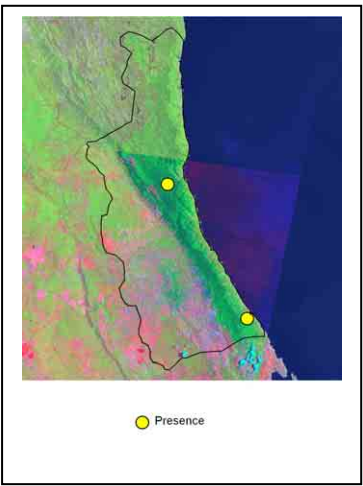
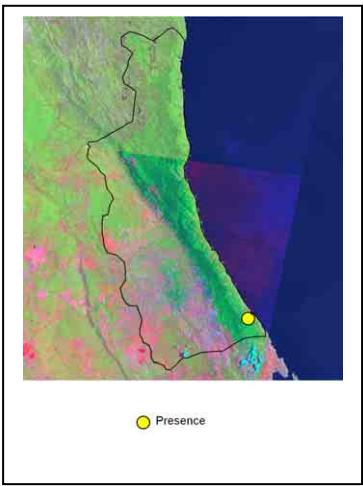
Bushpig dung  
encounter rate per km  
walked



Bongo (left) and Giant  
Forest Hog (right) sign

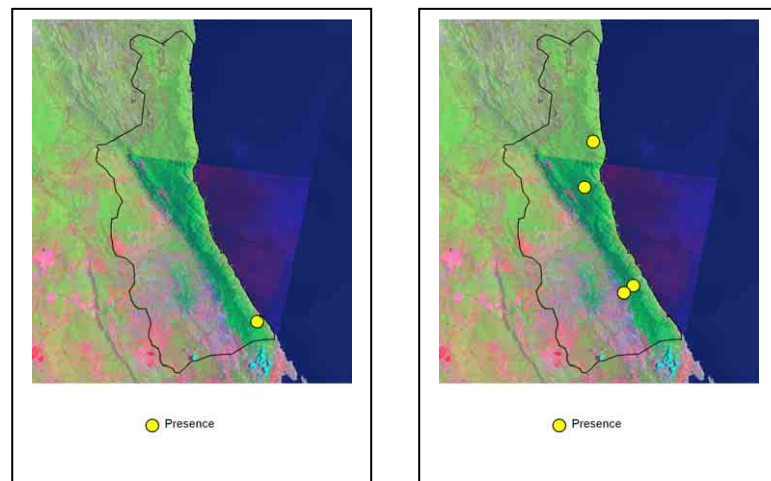


Dent's Monkey (left)  
and L'Hoeist Monkey  
(right) presence

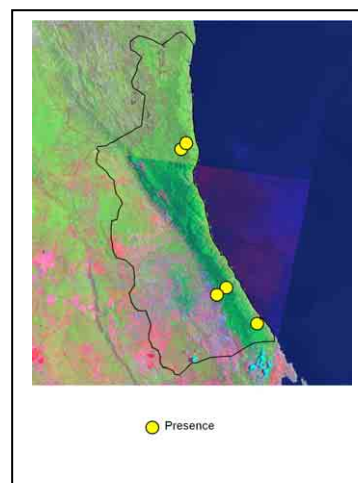


### Misotshi-Kabogo

Grey-cheeked  
Mangabey (left) and  
Red Colobus (right)  
presence



Redtail monkey presence



**Figure 2.2.** Locations of sightings of large mammal species giving presence/absence for monkeys, bongo and giant forest hog and encounter rates for chimpanzee nests and bushpig dung. Only blue monkey, baboon and chimpanzees were found at Muganja hills of the primates encountered.

#### ***Estimates of chimpanzee numbers.***

The nest densities given in Table 2.2 can be converted to estimates of chimpanzee densities by dividing the nest densities by the nest production rate (1.1/day) and the nest decay rate (49 days) as explained in the methods. Therefore we estimate chimpanzee densities to be around 1.22 chimps per square kilometer in the main forest block of Misotshi-Kabogo and 0.72/km<sup>2</sup> in the forest galleries. These densities are comparable to chimpanzee densities found elsewhere in the Albertine Rift region.

The Wood Hole Research Centre is working on the estimation of the amount of gallery forest and the area of the main forest block from satellite imagery in both the study regions and we do not have the areas calculated as yet. In order to obtain a preliminary estimate for this report we obtained a cruder estimate of forest area as follows:

1. We estimated the area of the main forest block to be 945 km<sup>2</sup> by using the forest cover estimated by an Africover data set for the region. Multiplying this area by the density of chimpanzees gives us an estimate of 1148 (+/-296 SE) chimpanzees for the Misotshi-Kabogo forest block.
2. We examined the satellite images of the two regions in the areas where only gallery forest exists and estimated by eye the percentage forest cover. Estimates by eye have been used to estimate forest cover in tropical forests and is also used to calculate crop yields in Europe by trained observers. While not as good as the measures we hope to obtain from Woods Hole Research Centre we believe it gives a reasonable first estimate. Using the areas we obtained we estimated that an additional 176 chimpanzees (+/- 127 SE) probably occur in the gallery forest to the west of the Misotshi-Kabogo forest block (estimating about 15% forest cover) and about 59 chimpanzees (+/- 20.5 SE) in the Muganja Hills region (estimating 3% forest cover).

It is clear therefore that the bulk of the chimpanzees that occur in this region are found in the main forest block of Misotshi-Kabogo. However the gallery forest extends further west than the boundaries we have delimited and could well contain more chimpanzees. We did not feel comfortable extrapolating much further though without survey data from these areas. The boundary we have produced for the Misotshi-Kabogo region is where we believe it might be possible to create a new protected area and within this boundary we estimate about 1,324 chimpanzees (+/- 423 SE) occur.

## Discussion

Fifty species of large and medium sized mammals were identified as probably occurring in the Misotshi-Kabogo region. Combined with the 21 species of small mammal that were discovered (chapter 3) we therefore have a known list of 71 species of mammal for the region. This is probably a minimum estimate however, because bats were not collected systematically and few shrews were caught during the surveys. The forest is relatively rich in primate species with 10 (or 11 if owl-faced guenons truly do occur here) and of these several are of conservation interest.

At least two of the primate species for this region are subspecies of those found further north in the main forest block of the Congo basin. The Angolan colobus that is confined to the Misotshi-Kabogo region (*Colobus angolensis progoginei*) was not observed from transects or recce walks but was observed once at camp B1 by one of the botanists. It is clear that this species has been heavily hunted in the forest and is in danger of disappearing completely. The red colobus (*Ptilocolobus oustaleti foai*) is also only found from this part of south eastern Congo and was observed at several of the camps in the forest as well as in the gallery forest to the west of the main forest block. It seems to be faring better than the Angolan colobus.

We did find one sign of the Bongo that was reported in the 1950s to occur in this forest. Signs of this animal (tracks) were observed at high altitude (around 2,500 metres). The only other site where this species occurs at this altitude is in Kenya, where it is considered to be a separate subspecies to the type found in the low altitude forest of the Congo basin. We therefore believe that it would be worth investigating this animal in more detail in the Misotshi-Kabogo forest, as it might deserve sub-specific listing also.

Chimpanzees in this region are near the southern limits of their range, particularly in the Muganja Hills region. We tried wherever possible to collect hairs from nests to

allow genetic analyses to be made. Unfortunately many of the nests we encountered were either old or inaccessible and we only managed to collect about 5 samples. These will be analysed by Dr K. Gonder at the University of Maryland in the USA.

From a conservation perspective it is clear that the Misotshi-Kabogo region is of great interest and deserves further investigation, particularly looking at the taxonomy of some of the species that occur here in more detail. The number of mammal species found in this study also indicates that the forest is valuable for conservation and that it deserves some form of protection.

## CHAPTER 3: Small Mammal Surveys of Misotshi-Kabogo

M.Huhndorf<sup>1,2</sup> and P.Kaleme<sup>3</sup>

1. Illinois State University, Normal

2. The Field Museum, Chicago

3. Centre de Reserche en Sciences Naturelles, Lwiro-Bukavu

### Introduction

The forests of the Albertine Rift represent important habitats for the flora and fauna of the region. There are 402 mammal species that have been recorded in the Albertine Rift, of these 34 are endemic (Plumptre et al., 2003; 2007). Many of these endemics are small mammals, rodents, shrews or bats. The Misotshi-Kabogo region had been previously surveyed for birds and some large mammals (Prigogine, 1960). However, the diversity of the small mammal (rodent, shrew and bat) fauna has never been surveyed in this region of the Albertine Rift.



### Methods

Between the 29<sup>th</sup> January and 24<sup>th</sup> February 2007 three camps within the Misotshi-Kabogo forest were accessed from two different fishing villages along the Lake Tanganyika shoreline. We established our first camp (5°28'45"S, 29°16'22"E) at an elevation of 1250 meters approximately 3 km west of Mizimu fishing village. The two remaining camps were established further north and were accessed from Talama fishing village that is located at the base of Misotshi. The second camp (4°59'29"S, 29°4'49"E) at an elevation of 1950 meters was established approximately 4 km southwest of Talama along the Mukungu River. The third camp (4°59'05"S, 29°5'34"E) at an elevation of 1600 meters was located approximately 2.5 km southwest of Talama.

Small mammals were sampled using a variety of techniques. Bats were sampled opportunistically utilizing the bird teams mist nets at one of the three camps. Rodents and insectivores were sampled using pitfall lines and trap lines consisting of Museum Special snap traps, Victor rat traps and Conibear traps. Pitfall lines were used to capture shrews and consisted of between fifteen and seventeen 5 liter buckets set 5 meters apart with a 25 cm high drift fence placed over the midline of the buckets. Trap lines consisted of between 30 to 60 traps; we ran either two or three trap lines depending upon the habitat. The majority of traps were placed on the ground but some were placed above ground on vines, tree limbs or fallen logs. We used a mixture of peanut butter and oatmeal as bait but occasionally also used some fish and corn kernels. All of the trap lines and pitfall lines were set up within 500 meters of their respective camps.

Data collected for all specimens included the microhabitat where each specimen was collected, sex, reproductive state as well as standard measurements, total length, tail length, ear length, hind foot length, forearm length for bats and weight. Specimens were prepared as study skins and skeletons or were preserved in 10% formalin with skulls removed these were later transferred to 70% ethanol. Tissue specimens were stored in the field in a saturated NaCl / EDTA buffer, upon returning from the field they were stored in an ultracold freezer at -70°C. Animals were handled in



accordance with American Society of Mammalogists guidelines (Animal Care and Use Committee, 1998). All specimens were deposited in The Field Museum, Chicago. Species accumulation curves were generated using the computer program EstimateS v8.0.0 (Colwell, 2005).

## Results

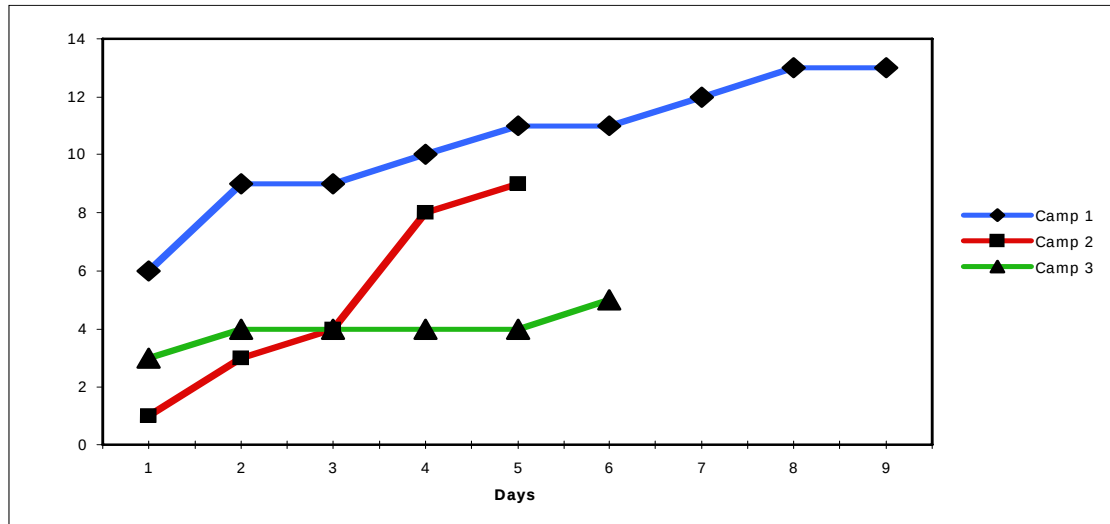
A total of 122 specimens were captured during the sampling period, representing 21 species (Table 3.1). These consisted of twelve species of rodents, five species of shrews and 4 species of bats. No animals were captured in either of the two pitfall lines (0 captures in 143 bucket-nights) all shrews collected on this survey were caught in trap lines. Trap line success at camp 1 was 10.1% (82 captures in 833 trap-nights). Trap line success was lower at camps 2 and 3; at camp 2 trap line success was 2.2% (11 captures in 510 trap-nights) and at camp 3 the success was 3.8% (24 captures in 630 trap-nights). One species of rodent, *Praomys jacksoni*, made up the majority (50% of total captured) of our captures. We collected one species of bat belonging to the sub-order Megachiroptera and 3 species of the sub-order Microchiroptera. Nets to capture bats were used on an opportunistic basis and should not be interpreted to represent the extent of the bat diversity in this region. Additionally, one specimen of a brush-tailed porcupine was collected with a snare set out by one of our guides.

We collected individuals across all age groups, adults, sub-adults and juveniles. Almost all of the adult rodents and some shrew species showed signs of being reproductively active. None of the bats collected appeared to be reproductively active.

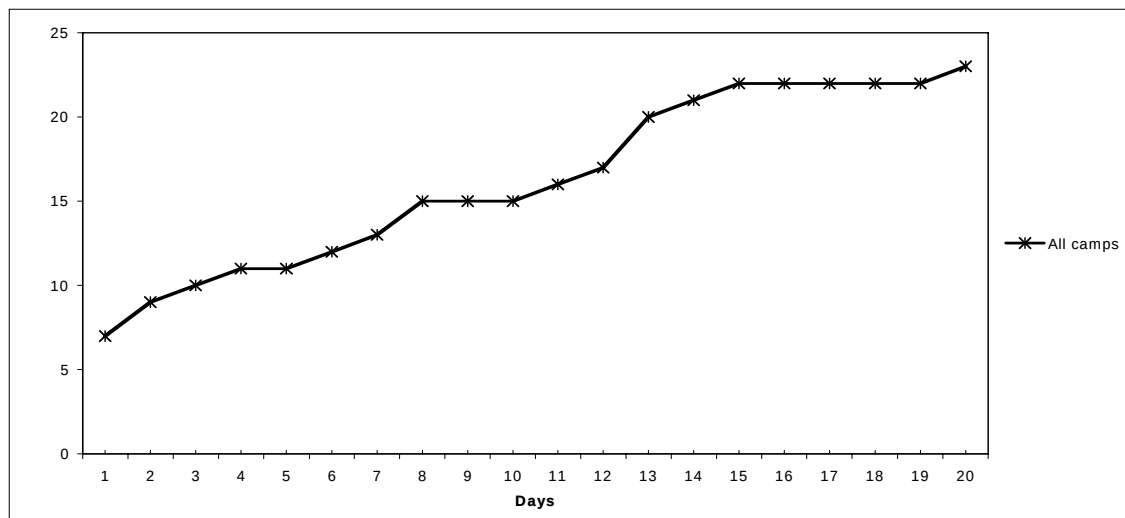
**Table 3.1.** List of small mammals collected in the Misotshi-Kabogo region during the survey period. The four new species are marked with an asterix.

| Species                             | total |
|-------------------------------------|-------|
| Insectivora                         |       |
| <i>Crocidura dolichura</i>          | 1     |
| <i>Crocidura cf. lanosa</i>         | 2     |
| <i>Crocidura olivieri</i>           | 3     |
| <i>Crocidura spp. (1 nov.) *</i>    | 5     |
| <i>Myosorex sp. nov. *</i>          | 1     |
| Chiroptera                          |       |
| <i>Stenonycteris lanosus</i>        | 1     |
| <i>Rhinolophus sp. nov. *</i>       | 4     |
| <i>Hipposideros ruber</i>           | 1     |
| <i>Pipistrellus cf. eisentrauti</i> | 1     |
| Rodentia                            |       |
| <i>Hybomys lunaris</i>              | 9     |
| <i>Hylomyscus sp. nov. *</i>        | 10    |
| <i>Lophuromys flavopunctatus</i>    | 11    |
| <i>Lophuromys sp.</i>               | 1     |
| <i>Mus minutoides</i>               | 2     |
| <i>Mus triton</i>                   | 1     |
| <i>Mus sp.</i>                      | 1     |
| <i>Praomys jacksoni</i>             | 61    |
| <i>Praomys degraaffi</i>            | 3     |
| <i>Rattus rattus</i>                | 1     |
| <i>Graphiurus cf. murinus</i>       | 1     |
| <i>Atherurus africanus</i>          | 1     |

The species accumulation curves for camps 1, 2 and for the overall survey rise steeply and do not reach an asymptotic plateau (Figs. 3.1, 3.2). This would indicate to us that our sampling of the small mammal fauna of the Misotshi-Kabogo region is incomplete. The curve for camp 3 would seem to indicate that the diversity at this camp was fairly low. This may have been due to sampling effort, the drier conditions at this site and overall lower habitat quality. Future sampling will be needed to compile a more complete list of small mammals from this region.



**Figure 3.1.** Species accumulation curves for small mammal species per days of collecting effort at each camp.



**Figure 3.2.** Species accumulation curve for small mammal species per number of days of collecting effort for the entire survey period.

## Discussion

The specimens collected in this survey represent the first collections of small mammals from one of the larger forest blocks remaining in the Albertine Rift. As such it represents a valuable resource for studies into the natural history, taxonomy and ultimately the conservation of Albertine Rift fauna. Due to limited sampling effort, particularly for shrews and bats, and the specific methodologies utilized the number of species represented in our survey most likely does not comprise the full diversity of the small mammal fauna in the Misotshi-Kabogo region. The lack of success utilizing pitfall lines was quite surprising since this method is usually more productive at capturing shrews than traditional snap traps. The low trap line success at our second and third camps was also unexpected when compared to the results from our first camp and from previous experience conducting other small mammal surveys in the Albertine Rift. Similar trapping effort on a recent survey of the Itombwe Massif located north of Misotshi-Kabogo resulted in a higher trap and pitfall line success rate than we achieved (unpublished data). The habitats of our camps were markedly different, the habitat at camp one could be described as transitional between lowland and montane forest and was close to the forest edge. Camp two was typical wet montane forest while camp three was drier forest on the eastern slope of the escarpment very close to the forest edge.

*Praomys jacksoni* is the most dominant species comprising 50% of the fauna captured. This appears to be typical when compared to 45-50% of rodent captures in the lower montane forest habitats of the Rwenzori Mountains (Kerbis Peterhans et al., 1998). Noticeably absent from our survey is the rodent *Lophuromys woosnami*, an Albertine Rift montane forest endemic found at low to medium elevations. This species was collected in the Itombwe Massif survey (Kaleme, pers. comm.) so we expected to collect it in Misotshi-Kabogo. It is possible that this species was unable to cross the Kilombwe River valley, the major barrier that separates Misotshi-Kabogo from Itombwe.

This preliminary survey highlights the need for additional work in the Misotshi-Kabogo region. Four of the species that were collected are new to science. The *Rhinolophus* sp., *Myosorex* sp. one of the *Crocidura* sp. and the *Hylomyscus* sp. could not be attributed to any of the known species found in the Albertine Rift or elsewhere. These data presented here highlight the importance and uniqueness of this region to understanding the natural history of the small mammal fauna of the Albertine Rift.



**Photo 3.1.** The new species of *Rhinolophus* bat.

## CHAPTER 4: Bird Surveys

H.Mugabe, B.Marks, C.Kahindo, D.Moyer, A. Masanga, A.J.Plumptre,  
D.Kujirakwinja and Elia Mulungu

### Introduction

Birds are good indicators about the relative health and integrity of the forest. They are also readily identified, and good guides exist to help in their identification visually as well as their calls. There are 42 endemic birds associated with the Albertine Rift and associated Eastern Zairean lowlands (nowadays the two areas are combined in the Albertine Rift; Plumptre et al. 2007). Of these birds several are poorly known with no recordings of their calls and little known about their ecology and habitat use. One, the Kabobo Apalis (*Apalis kaboboensis*), is only known from the Misotshi-Kabogo area but little else was known about it.



These surveys therefore aimed to collect some information on the birds of the Misotshi-Kabogo area as well as the Muganja Hills area. The region around the hill called Kabobo was surveyed in the 1950s by collectors sent by Prigogine (1960) in 1953, 1954, 1955 and 1957. Collections were made in October and November most years with some collecting in May 1955. A total of 146 species of bird were collected during this time for Kabobo hill and an additional 85 were recorded in the region surrounding the massif. It was at this time that the Kabobo Apalis was identified (Prigogine, 1960, 1985). However since then there has been some dispute about whether this Apalis should be a separate species or only a subspecies of the Chestnut-throated Apalis (*A. porphyrolaema*) (Urban, Fry and Keith, 1997). Eighteen Albertine Rift endemic species were recognised by Prigogine (1960) during these surveys, of which the Kabobo Apalis is one.

We know of no other surveys of birds since the 1950s because of the insecurity that occurred in this region.

### Methods

A combination of identification and listing of species and point counts to provide more quantitative data were employed. Mist netting was used primarily to collect specimens for the Field Museum in Chicago but also to help increase the species lists at each site (Appendix 1). Three ornithologists (H.Mugabe, A. Masanga and D. Kujirakwinja) on the two teams had undertaken surveys in many other Albertine Rift Forests and knew the calls of most of the bird species. Elia Mulungu recorded the calls of many of the birds using a Marantz tape recorder, aiming in particular to record the calls of those species whose call had not been recorded before.

At each camp birds would be identified by sight and call and a daily species list built up to calculate the total numbers of species for the site and the relative accumulation curves for the sites. Point counts would be made at every 250 metres of transect and reconnaissance walk made by the large mammal teams (chapter 2). Mist nets were generally placed around the camp site or its near vicinity and checked every 30 minutes.

Data were analysed in Biodiversity Professional for diversity measurements and rarefaction curves and Arcview 3.2a for geographical data.

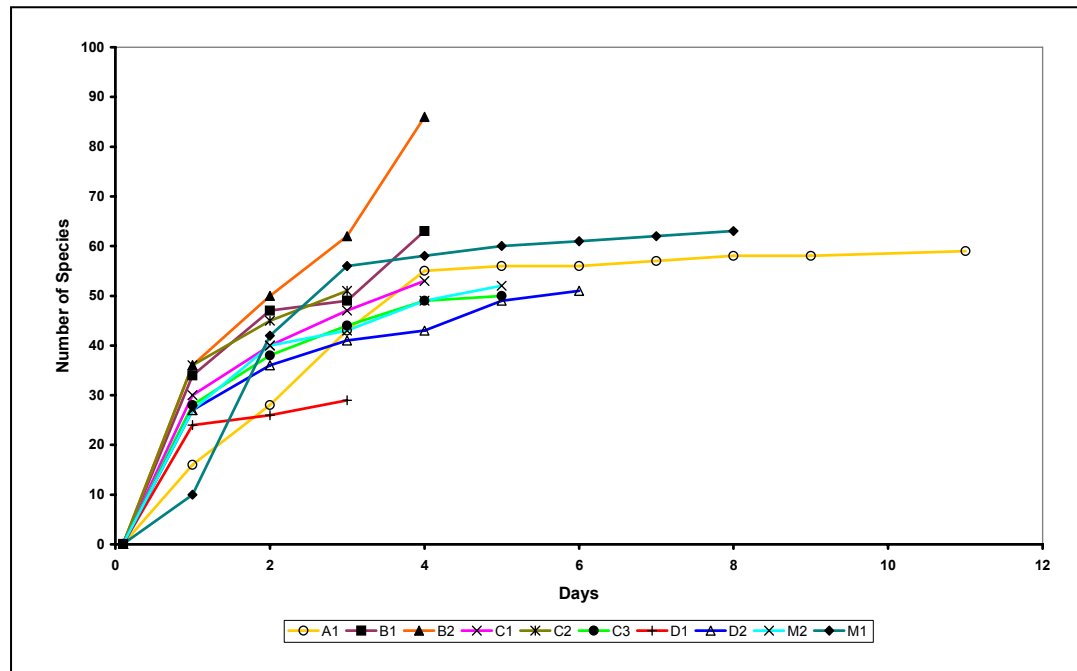
## Results

### *Total numbers of species per site*

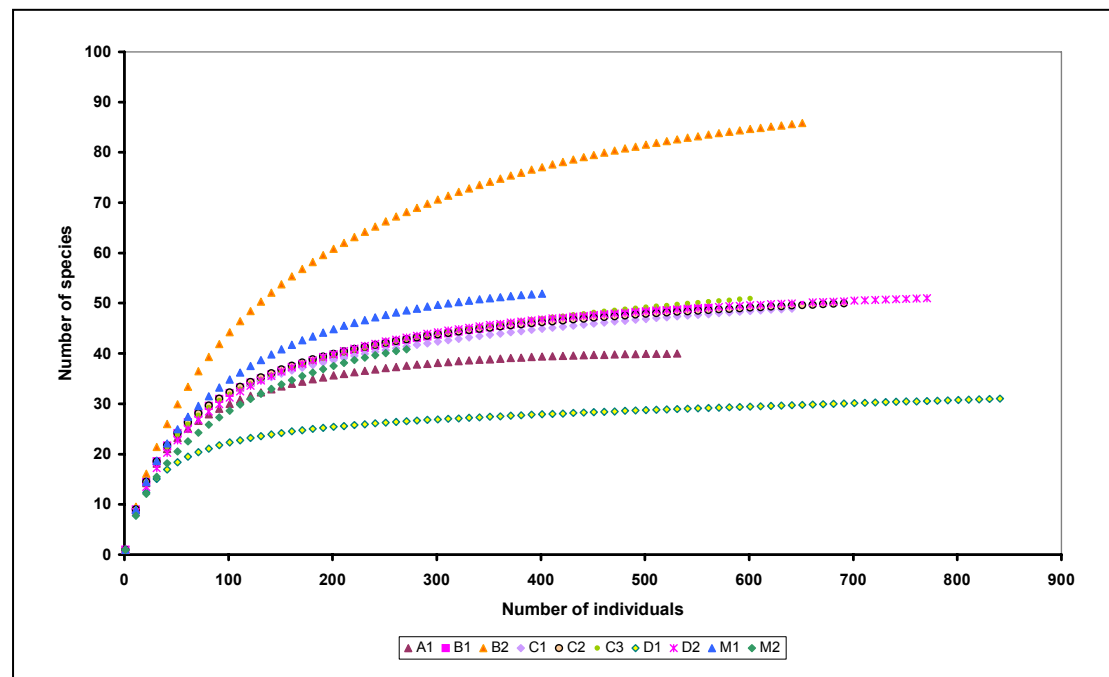
A total of 214 species of bird were observed at each of the camps in both the Misotshi-Kabogo Forest and the Muganja Hills. A total of 83 species were found for the Muganja Hills and 158 species for the Misotshi-Kabogo Forest. Of these 158 species, 74 were new species for the list that Prigogine had created for Kabobo (Prigogine, 1960). This brings the total list of birds for the Misotshi-Kabogo region to 305 species.

21 Albertine Rift Endemic Species were encountered of which 3 were new for the forest (Grauer's Warbler, *Graueria vittata*, Purple-breasted Sunbird, *Nectarinia perpureiventris*, and Rwenzori Double-collared Sunbird, *Cinnyris stuhlmanii*). In addition the Mountain Masked Apalis (*Apalis personata*) has been recognized as an Albertine Rift Endemic since Prigogine's paper. The only endemic species we did not encounter that was collected by Prigogine was the Dusky Crimsonwing (*Cryptospiza jacksoni*). There are therefore 22 known endemic species for the Misotshi-Kabogo Forest in total.

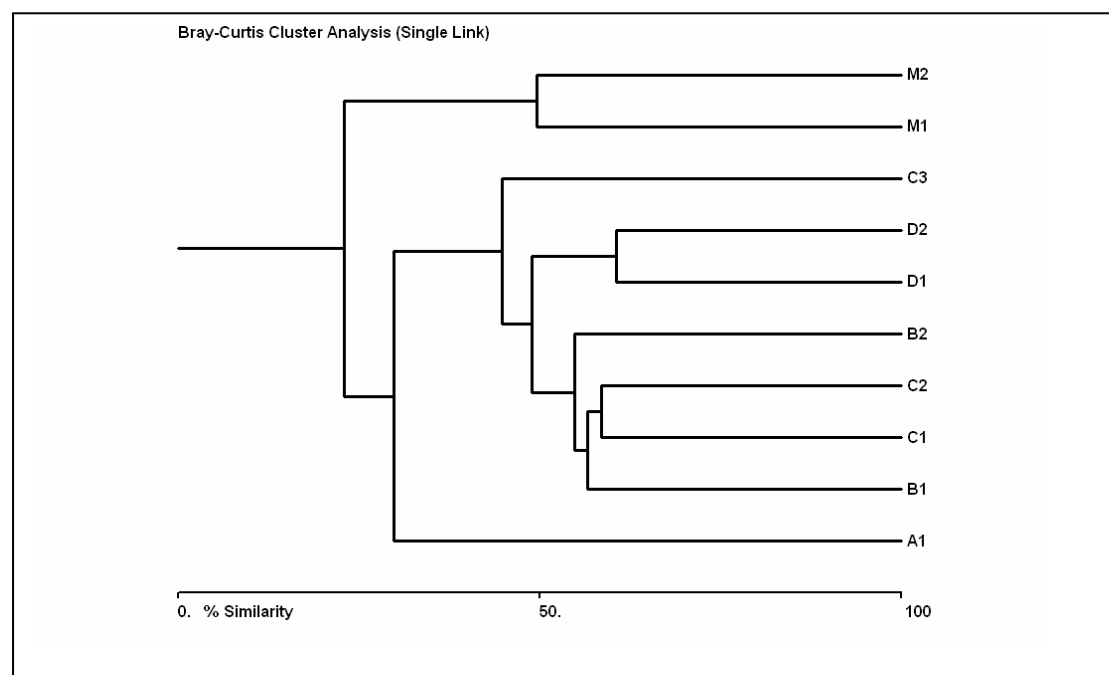
The sites with greatest bird diversity (Fig. 4.1) were those at low to medium altitudes in Misotshi-Kabogo and in Muganja hills (B1, B2, C2, A1 and M1) when looking at accumulation of species per day of survey effort. Similar curves are produced when calculating rarefaction curves from point count data per number of individual birds seen (Figure 4.2). Site B2 is even richer in species compared with other sites probably because it consisted of montane and medium altitude forest as well as grassland. It is not clear why D1 had much less diversity but it may be due to little variation in available habitat types.



**Figure 4.1.** Species accumulation curves for sightings of species per days observation at each camp site.



**Figure 4.2.** Rarefaction curves for birds seen from point counts at each of the sites.

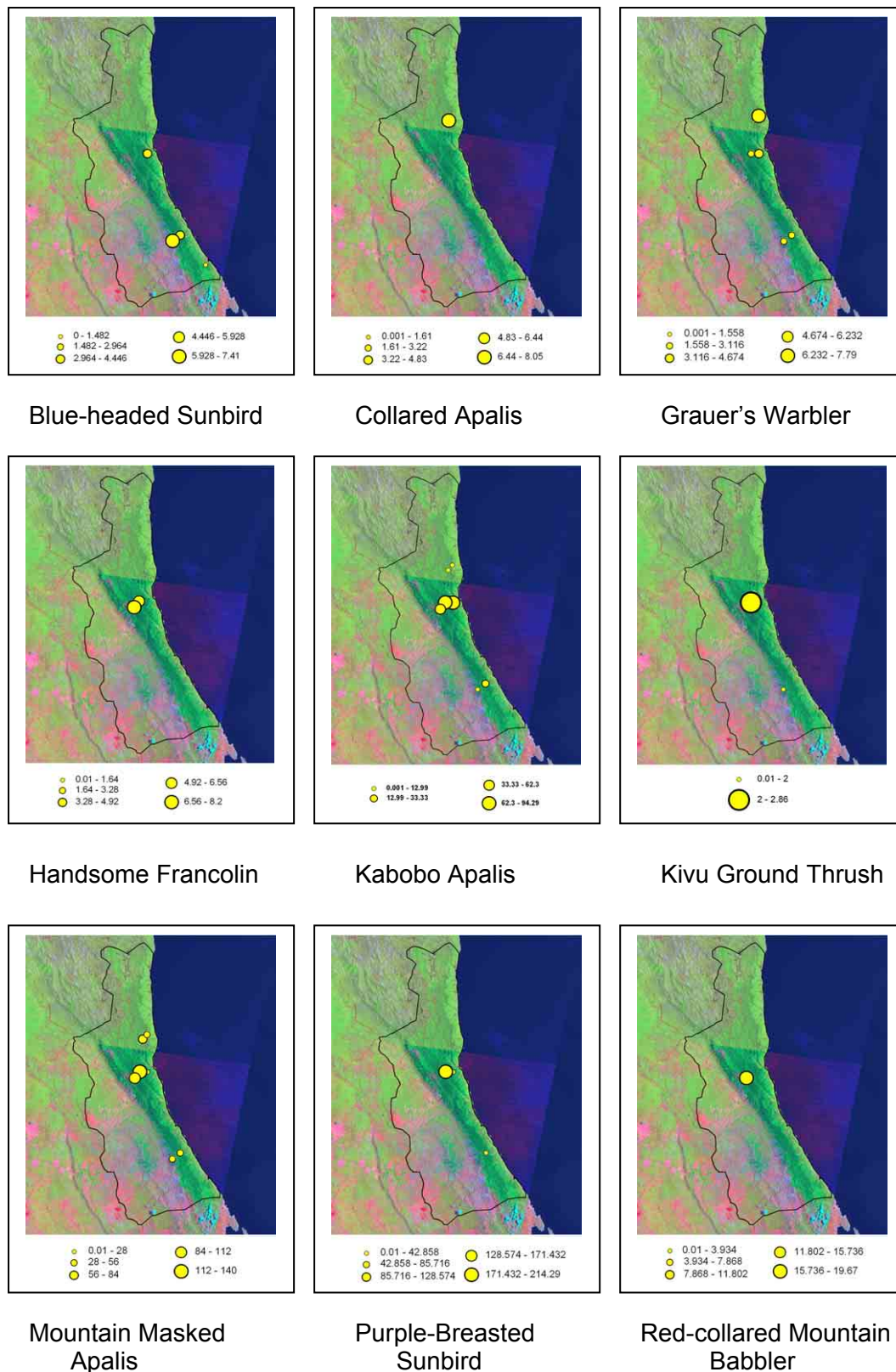


**Figure 4.3.** Cluster analysis of point count data showing similarity between birds observed at each of the camps.

Cluster analysis of the point count data for each of the camps (figure 4.3) shows how different the two camps in the Muganja hills area are from the Misotshi-Kabogo camps (splitting at about 25% similarity). The lower altitude camp at A1 is also very different to the higher altitude camps.

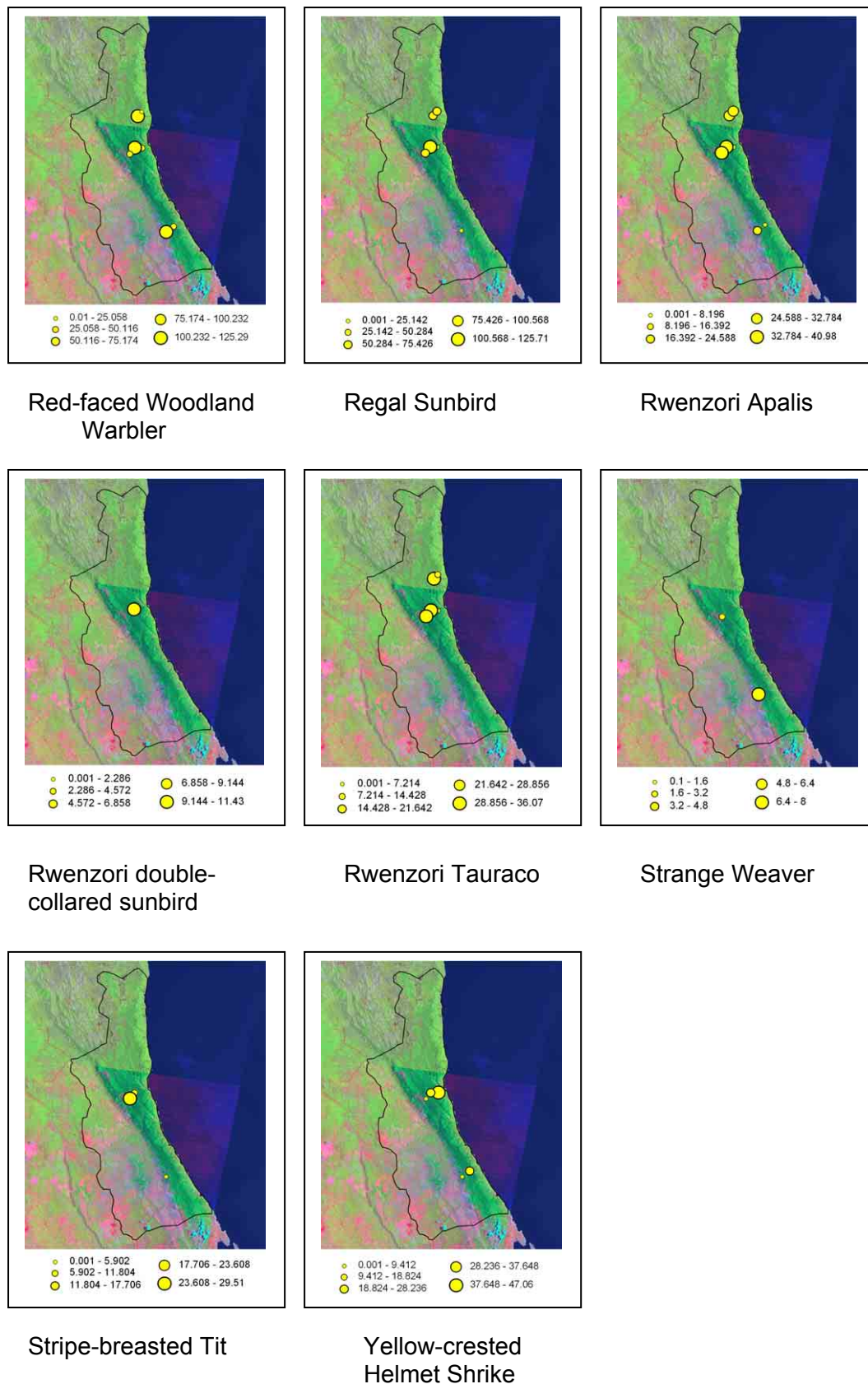
#### ***Endemic bird species distributions***

Distributions and relative abundance (encounter rate at point counts) of the Albertine Rift Endemic species seen at point counts are mapped in figure 4.4 (a and b).



**Figure 4.4 a.** Distribution of sightings of endemic bird species at the various camp locations visited with relative abundance indicated by circle size.





**Figure 4.4 b.** Distribution of sightings of endemic bird species at the various camp locations visited with relative abundance indicated by circle size.

### ***Calls of selected bird species***

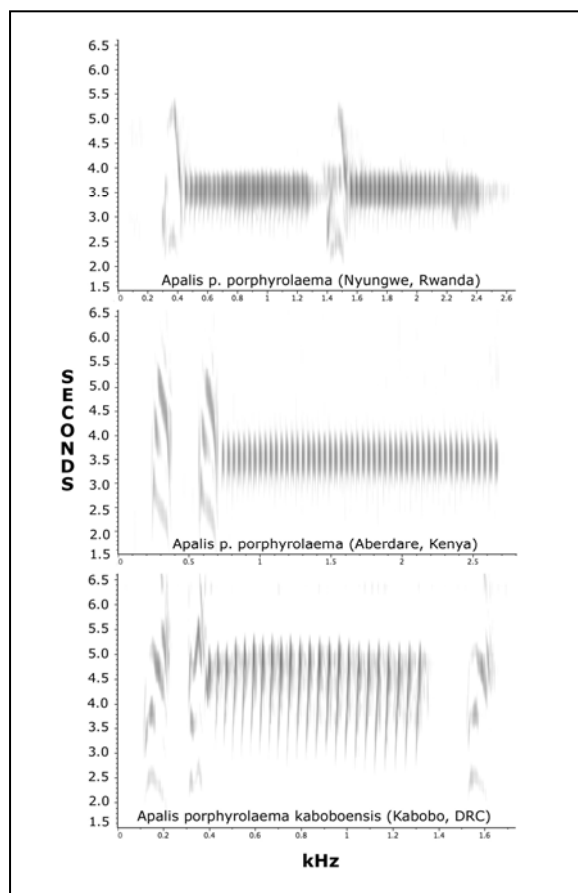
Observations and sound recordings made during this survey were useful in clarifying the taxonomic status and ecological relationships for several species. In some cases, these data were hitherto unknown. Selected notes on these are presented below.

#### **Kabobo Apalis, *Apalis porphyrolaema kaboboensis***

This very distinctive form was described by Alexander Prigogine in 1955. He considered it to be a distinct species, but most authors have treated it as conspecific with the Chestnut-throated Apalis (Hall & Moreau 1970, Urban et al. 1997). It differs largely in the chestnut on the chin, throat, and upper breast being replaced by dark grey.

Kabobo Apalis was common in the canopy (from 1,602m up to 2,691m) and several recordings were made of its song by Elia Mulungu. Comparisons of the song of Kabobo Apalis were made with recordings of Chestnut-throated Apalis from Nyungwe Forest, Rwanda and the Aberdares in Kenya. Generally, these were quite similar, with the most isolated form, the Kabobo Apalis, being the most divergent.

The song of this species appears to be a duet, with one bird giving one or two chirp calls and the other giving a long trill. The timing for these two elements of the call is very precise. There is quite a bit of variation in the song structure within and between populations. However, in the field, it is immediately obvious that the Kabobo Apalis belongs to the Chestnut-throated group vocally. Variation within a population or region is at least as significant as that between populations (Figure 4.5).



**Figure 4.5.** Spectrograph of the songs of Chestnut-throated Apalis *Apalis porphyrolaema* from 3 different sites

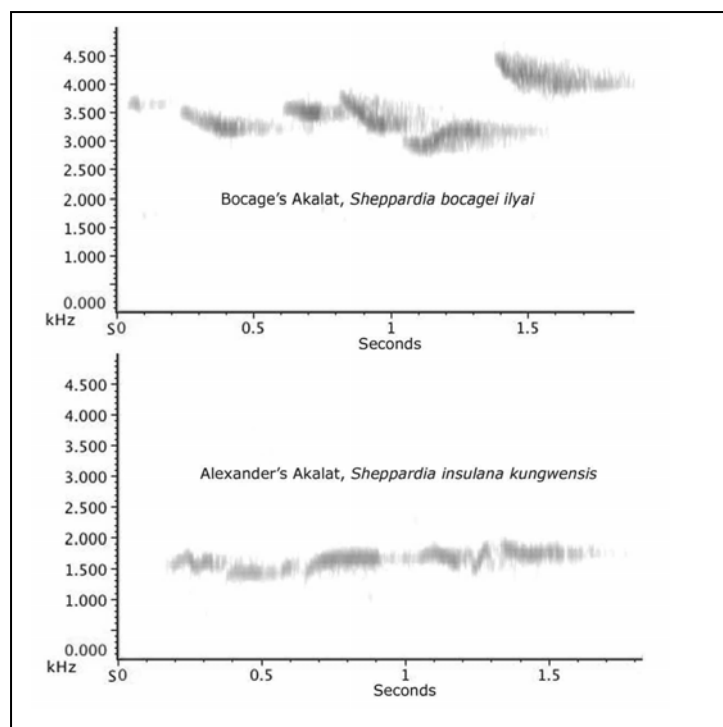
Variation in the song structure is largely in the sequence of the chirp notes and in the duration and number of elements in the trill. The calls recorded at Kabobo were most similar to the songs from the Aberdares, but the entire song phrase was shorter. Sequence and number of the chirps is also variable, both within and between populations. In Kabobo Apalis the song phrase is most often preceded by two chirps, then a trill and ended by a chirp. However, the second chirp and the trill run together so that the overall effect in the field sounds like a trill preceded and ended by a single chirp. In Nyungwe the trill is preceded by a single chirp, but then a second chirp/trill combination is given immediately. The song of the Aberdare form is more similar in structure to the Kabobo birds but the two chirps preceding the trill are clearly audible. In all populations, the trill is occasionally given by one bird with the other preliminary chirp notes given by the other.

#### Bocage's (Kabobo) Akalat, *Sheppardia bocagei (poensis) kaboboensis*

Moreau (1941) gave a description of a new robin (akalat) collected in Mahale at 2400 m on 8 August 1940. In deference to the opinion of Claude Grant, he described this as a subspecies of the Grey-winged Robin-chat, *Cossypha polioptera kungwensis*. This specific assignment was found to be in error because of the shorter tail and longer tarsus of *C. p. kungwensis*. Chapin thought it was a new subspecies of Alexander's Robin-chat, *Cossypha insulana kungwensis* but Moreau did not agree and named it the Kungwe Robin-chat, *Cossypha kungwensis*, pending clarification of its affinities (Moreau 1943, Chapin 1953). Macworth-Praed and Grant (1955) followed Chapin and listed it as a subspecies of Alexander's Robin-chat, *C. i. kungwensis* following the opinion of James Chapin, but later on, Moreau and Benson (1956) sunk *insulana* into *bocagei* along with *kungwensis*. Since then, most taxonomists have lumped all forms of *bocagei* and *insulana* into Bocage's Robin-chat (White 1962, Hall and Moreau 1970, Britton 1980, Keith *et al* 1992). More recently, taxonomists (Wolters 1983) have placed this complex into *Sheppardia*, the akalats, a change first suggested by Hall and Moreau (1970). When the genus *Sheppardia* is used, the name *poensis* (Alexander) supersedes *insulana* Grote, (Prigogine 1987, Keith *et al* 1992).

In the mid 1980s, Alexander Prigogine re-evaluated the *bocagei* complex of akalats and concluded that morphological evidence supported the treatment of the *insulana* and *bocagei* groups as separate species (Prigogine 1987). He still kept both groups within the robin-chats, *Cossypha*, hence his continued use of *insulana* for the northern "short-winged" montane forms. However, his opinion was not followed by the authors of the Birds of Africa (Keith *et al* 1992). Instead, they opted to follow Hall and Moreau (1970) by deferring the decision on whether to lump or split the *insulana/bocagei* group until more information on the biology of this species became available. They did however, use the genus *Sheppardia* for the *insulana/bocagei (poensis)* group

Recent fieldwork in Western Tanzania on both sides of the contact zone between Alexander's Akalat (the *poensis / insulana* group) and Bocage's Akalat, (the *bocagei* group), has contributed new ecological and bioacoustic information to the discussion (Moyer 2006, Moyer *et al* 2006). Bocage's Akalat, *Sheppardia bocagei ilyai* was found 60 km to the east of Mahale Mountains in the Sitebe-Sifuta Mountains. It was common in gallery and riverine forest at 1700 m (a habitat very similar to that preferred by *S. b. chapini* in northern Zambia) and recordings were made of its song. Recordings were also made of the song of *S. b. kungwensis* in montane forest at 2400m in Mahale Mountains National Park. During this survey, recordings were made of the song of *S. bocagei kaboboensis* on Kabobo Mt., by Elia Mulungu (Figure 4.6).



**Figure 4.6.** Spectrogram of the songs of Alexander's & Bocage's akalats.

Although all three forms differed only slightly in appearance, there were major differences in the songs and habitat preference between Bocage's and Alexander's akalats. The song of *S. b. kungwensis*, in the Alexander's Akalat group, is virtually identical to the song of *S. b. kaboboensis* from just across Lake Tanganyika, and to that of *S. b. granti* on Mt. Cameroon more than 2400 km away. (recorded by M. E. Gartshore (Chappuis 2000)). However, the song of *S. b. ilyai*, in the Bocage's Akalat group, was found to be identical to that of *S. bocagei chapini* from northern Zambia and southern Tanzania (recorded by R. Stjernstedt (Chappuis 2000)).

The fundamental frequency of the song phrase of Alexander's Akalat from Mahale is 1257 Hz and the highest frequency is 1943 Hz. The fundamental frequency of Bocage's Akalat from just east of Mahale is 2715 Hz with the highest frequency at 4537 Hz. Claude Chappuis (*pers. comm.*, December 2005) states that the difference in pitch alone is enough evidence to treat them as separate species.

These two forms are within 60 km of each other, yet each are more similar to distant forms in vocalizations and habitat choice than to each other. It is clear from this that they should be treated as separate species; Bocage's and Alexander's akalats. The subspecies of Bocage's Akalat in Ufipa (less than 100 km to the south of the nearest population of *ilyai*) is *chapini* (Moyer and Stjernstedt 1982). This same subspecies is found all over northern Zambia and SE Democratic Republic of Congo (Chapin 1953, Benson *et al* 1971, Keith *et al* 1992). It would appear then that the Karema Gap has been a major biogeographical barrier isolating *ilyai* from contact with *chapini* and allowing discernable morphological divergence to have taken place between the two

In spite of a long separation between *ilyai* and *chapini*, their songs are still virtually identical, just as in the songs of Alexander's akalats from Mahale, Kabobo and Mt. Cameroon. The latter similarity is all the more surprising because these forms are separated by much more significant biogeographical barriers. Therefore, divergence in the relatively simple songs of this group appears to be more conservative than morphological divergence. It is extremely unlikely that the vocal differences between *C. b. ilyai* and *C. b. kungwensis*, and by extension, between Bocage's and

Alexander's akalats, could have arisen over a short distance in western Tanzania with no significant ecological or biogeographical barriers.

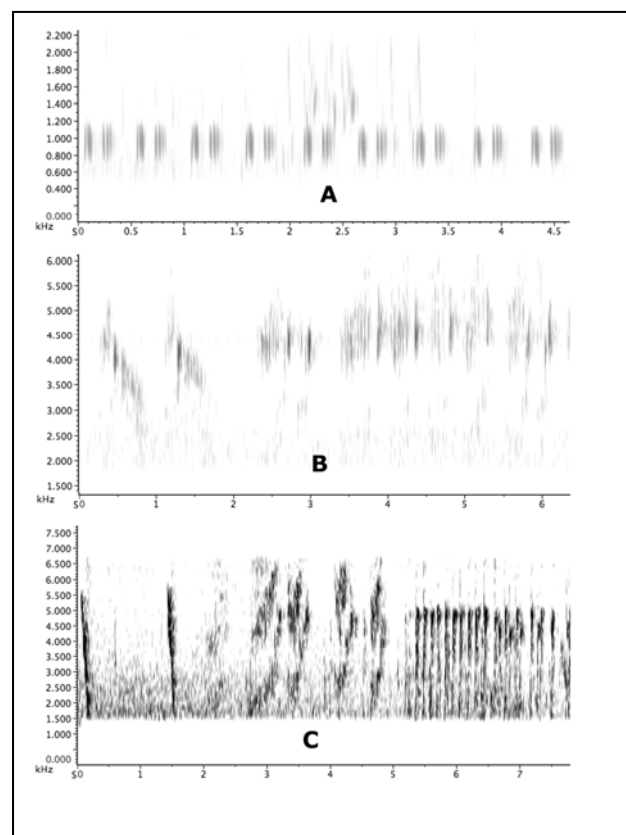
Yellow-crested Helmet-Shrike, *Prionops alberti*

The Yellow-crested Helmet-Shrike is one of the lesser-known Albertine Rift endemics. The type specimen was found dead and mummified on the summit of Mt. Mikenno, one of the Virunga Volcanoes (Chapin 1954). It is known only from half a dozen sites and, up to now, its vocalizations remained unrecorded (Fry *et al* 2000). During this fieldwork this species was encountered in groups of between 3 and 8 individuals from 1,770 m to 2,474 m. Several recordings were made of its calls by Elia Mulungu (Figure 4.7). Although it is difficult to describe the complex calls of Helmet-Shrikes in words, the spectrograms above can be rather imperfectly described as follows:

A = Musical far-carrying double notes most characteristic of this species, with a second bird overlaying an oriole-like liquid bubbling type call in the middle of the sequence.

B= up slurred 'dzreeeeooo' repeated twice then a chattering call similar to that given by most of the other species of Helmet-Shrikes.

C=sharply down slurred 'zwerp', 'zwerp', then a nasal 'gurry-gurry', repeated 4 times followed by a piping that is vaguely reminiscent of one of the calls of the Dusky Long-tailed Cuckoo, *Cercococcyx mechowi*.



**Figure 4.7.** Spectrogram of the vocalizations of the Yellow-crested Helmet-Shrike, *Prionops alberti*

## Discussion

The surveys we made increased the number of Albertine Rift endemic bird species from 18 to 22. However we have also thrown doubt on the taxonomy of the Kabobo Apalis which may need to be revised based on the recordings of its calls that we made. It may be better to classify it as a sub species of the chestnut-throated Apalis. This would reduce the number of endemic species to 21. Only five other sites have more Albertine Rift endemic bird species (Itombwe Massif, Kahuzi Biega Park, Nyungwe Park, Virunga Park, and Bwindi Impenetrable Park). Misotshi-Kabogo therefore ranks higher than most of the 33 sites where birds have been recorded in the Albertine Rift.

In addition we have increased the total species list for the forest from 231 to 305 species making the place far more significant for bird conservation. Fifteen of the 33 sites in the Albertine Rift have more species recorded than Misotshi-Kabogo but most of these are in Uganda where the effort made in recording species is far greater. Previously bird surveys to this region had involved sending collectors to the forest, who collected specimens which were later identified to produce a species list. This was the first study for the region which provided quantitative data on relative species abundances (figures 4.4a and b) and allowed accumulation curves to be produced (figures 4.1 and 4.2). The accumulation curves indicate that we managed to survey a good majority of the bird species in the forest although there are still likely to be some other species to find. Most of the curves are leveling off for most of the sites. We therefore believe that the 305 species which now are listed for the region are probably a reasonable estimate but may increase to about 350-400 with longer term studies. Often the lists are augmented by occasional migrant species or unusual records (such as pelicans flying over a forest) and as a result total lists don't mean very much.

Of the species listed for the forest the Yellow-crested Helmet Shrike is listed as Vulnerable and the Kabobo Apalis as data deficient by the IUCN red list. All other species are not considered to be threatened. As such the forest is not particularly rich in threatened bird species. Kabobo Apalis was only observed above 1,600 metres and up to 2,750 metres a.s.l. (maximum altitude of forest block). It is unlikely therefore to occur in the gallery forest to the west of the main forest block which lies at about 1,500 metres a.s.l. As such it is probably confined to this forest unlike the Kungwe Apalis across the lake which is widespread around the Mahale Mountains National Park at lower altitudes (Moyer *et al.* 2006). If it remains a distinct species it probably deserves some form of threatened status based on the fact that the forest is unprotected as yet and that it is likely confined to this forest block.

We obtained the first recording of Kabobo Apalis and Yellow-crested Helmet Shrike calls and these will be posted on the WCS Albertine Rift web site ([www.albertinerift.org](http://www.albertinerift.org)) for any ornithologists to download freely. We hope this will help with the identification of these two species in future forest surveys and allow better records of their distributions to be made.

## CHAPTER 5: Herpetological surveys

D.Moyer, E.Mulungu, J. Matunguru, M. Menegon, D. Meirte and  
A.Plumtre

### Introduction

Reptiles and amphibians have been less frequently carried out in Albertine Rift Forests and these Herpetiles are therefore less well known from the region. It is known that about 119 amphibian species and 175 reptile species can be found in the Albertine Rift (Plumtre et al. 2003), of which 16 reptiles and 36 amphibians are endemic to the Albertine Rift (Plumtre et al. 2007). The Belgian herpetologist Laurent collected from the Kabobo region during the 1950s and his collection is housed at the Africa Museum in Tervuren and he published on some of the species he collected (Laurent 1952). With the help of Danny Meirte at this Museum the list of endemic species for the Albertine Rift was compiled in 2003. He identified seven endemic amphibian species and two endemic reptiles that occur in the Mistotschi-Kabogo region:



#### *Amphibians:*

1. *Callixalus pictus*
2. *Hyperolius leucotaenius*
3. *Leptopelis fiziensis*
4. *Phrynobatrachus dalcqi*
5. *Schoutedenella hematoaster*
6. *Schoutedenella pyrrhoscelis*
7. *Xenopus wittei*

#### *Reptiles:*

1. *Atheris nitschei*
2. *Chamaeleo schoutedeni*

However, a complete list for the forest has not been compiled to our knowledge. As part of these surveys we aimed to collect specimens of amphibians and reptiles and collate data on existing specimens held at the Africa Museum in Tervuren to start to create a list for the two sites; Misotshi-Kabogo and Muganja Hills.

### Methods

Amphibians and reptiles were collected wherever they could be found during the surveys. Elia Mulungu and Joseph Matunguru would search around small rivers and streams at each camp site visited by one of the survey teams (Camps B1, B2, C1, C2, C3 in Misotshi-Kabogo and Camps M1 and M2 in the Muganja Hills). Reptiles and Amphibians were caught by hand or net and preserved in 10% formalin. On completion of the surveys the specimens were transferred to Tanzania for identification by David Moyer and Michel Menegon, with permits from the Centre de Recherche en Sciences Naturelles de Lwiro. Notes were made of the GPS position of the collection locations for the specimens and their distance to streams/rivers and habitat type where collected.

41 specimens of amphibian were collected in the Muganja hills and 85 specimens in the Misotshi-Kabogo Forest. Five snakes and 3 chameleons were also collected in the Misotshi-Kabogo Forest.



Danny Meirte, in the Herpetology Department at the Africa Museum in Tervuren, also compiled a list of species that had been collected in the past within the two areas delimited in figure 1.3.

## Results

Species that had been collected from these two regions previously included 40 reptiles (Table 5.1) and 22 amphibians (Table 5.2).

**Table 5.1.** List of reptile species collected in the Misotshi-Kabogo and Muganja hills regions and located at the Africa Museum, Tervuren.

| Species                                             | Misotshi-Kabogo | Muganja Hills |
|-----------------------------------------------------|-----------------|---------------|
| <i>Acanthocercus cyanogaster</i>                    | 1               | 1             |
| <i>Atheris nitschei</i>                             | 1               |               |
| <i>Bitis arietans</i>                               |                 | 1             |
| <i>Lamprophis lineatus</i>                          | 1               | 1             |
| <i>Boulengerina annulata stormsi</i>                | 1               |               |
| <i>Causus rhombeatus</i>                            |                 | 1             |
| <i>Chamaeleo dilepis idjwiensis</i>                 | 1               |               |
| <i>Chamaeleo dilepis dilepis</i>                    |                 | 1             |
| <i>Chamaeleo gracilis gracilis</i>                  | 1               |               |
| <i>Chamaeleo johnstoni</i>                          | 1               |               |
| <i>Chamaeleo quilensis</i>                          | 1               | 1             |
| <i>Chamaeleo rudis rudis</i>                        |                 | 1             |
| <i>Chamaeleo rudis schoutedeni</i>                  | 1               |               |
| <i>Crotaphopeltis hotamboeia</i>                    | 1               | 1             |
| <i>Dasypeltis atra</i>                              | 1               |               |
| <i>Dasypeltis scabra</i>                            | 1               | 1             |
| <i>Dipsadoboa shrevei shrevei</i>                   | 1               |               |
| <i>Dipsadoboa unicolor viridiventris</i>            | 1               |               |
| <i>Dromophis lineatus</i>                           |                 | 1             |
| <i>Duberria lutrix currylindhali</i>                | 1               |               |
| <i>Hemidactylus mabouia</i>                         | 1               |               |
| <i>Kinixys belliana</i>                             | 1               |               |
| <i>Lycodonomorphis bicolor</i>                      |                 | 1             |
| <i>Lycophidion capense jacksonii</i>                | 1               |               |
| <i>Lygodactylus angularis paurospilus</i>           | 1               |               |
| <i>Lygodactylus picturatus gutturalis</i>           |                 | 1             |
| <i>Mabuya maculilabris</i>                          |                 | 1             |
| <i>Mabuya striata</i>                               |                 | 1             |
| <i>Naja nigricollis atriceps</i>                    |                 | 1             |
| <i>Natriciteres fuliginoides</i>                    |                 | 1             |
| <i>Natriciteres olivacea</i>                        |                 | 1             |
| <i>Pelomedusa subrufa subrufa</i>                   |                 | 1             |
| <i>Philothamnus heterodermus ruandae</i>            | 1               |               |
| <i>Philothamnus heterolepidotus</i>                 | 1               | 1             |
| <i>Philothamnus irregularis irregularis</i>         | 1               |               |
| <i>Philothamnus semivariiegatus semivariiegatus</i> | 1               |               |
| <i>Psammophis sibilans</i>                          |                 | 1             |
| <i>Python sebae</i>                                 | 1               |               |
| <i>Mochlus sundevalli</i>                           |                 | 1             |
| <i>Typhlops angolensis adolfi</i>                   |                 | 1             |

**Table 5.2.** List of amphibian species collected in the Misotshi-Kabogo and Muganja hills regions and located at the Africa Museum, Tervuren.

| <b>Species</b>                                  | <b>Misotshi-Kabogo</b> | <b>Muganja Hills</b> |
|-------------------------------------------------|------------------------|----------------------|
| <i>Afrana angolensis</i>                        | 1                      |                      |
| <i>Afraxalus wittei</i>                         | 1                      | 1                    |
| <i>Hydrophylax galamensis</i>                   |                        | 1                    |
| <i>Arthroleptis stenodactylus stenodactylus</i> |                        | 1                    |
| <i>Bufo regularis</i>                           |                        | 1                    |
| <i>Callixalus pictus</i>                        | 1                      |                      |
| <i>Hemisus guineense katanganum</i>             | 1                      |                      |
| <i>Hemisus marmoratus</i>                       |                        | 1                    |
| <i>Hyperolius kivuensis</i>                     |                        | 1                    |
| <i>Hyperolius argentovittis</i>                 |                        | 1                    |
| <i>Hyperolius nasutus nasicus</i>               |                        | 1                    |
| <i>Kassina senegalensis angeli</i>              | 1                      |                      |
| <i>Leptopelis bocagii</i>                       |                        | 1                    |
| <i>Leptopelis kivuensis</i>                     | 1                      |                      |
| <i>Phrynobatrachus dalcqi</i>                   | 1                      |                      |
| <i>Phrynobatrachus natalensis</i>               |                        | 1                    |
| <i>Phrynobatrachus perpalmatus</i>              |                        | 1                    |
| <i>Ptychadena mascareniensis mascareniensis</i> |                        | 1                    |
| <i>Ptychadena oxyrhynchus</i>                   |                        | 1                    |
| <i>Ptychadena uzungwensis</i>                   | 1                      |                      |
| <i>Xenopus laevis laevis</i>                    |                        | 1                    |
| <i>Xenopus wittei</i>                           | 1                      |                      |

Species collected from Misotshi-Kabogo were identified by Michele Menegon. Several specimens are still in the process of being identified and the current list is given in Table 5.3. Amphibian taxonomy follows Frost et al. (2006). References consulted included Amiet (1973), Barbour and Loveridge (no date), Channing and Howell (2005), De Witte (1921), Drewes and Vindum (1994), Laurent (1952, 1956, 1958, 1974), Pitman (1974), Schiøtz (1975, 1999), Spawls et al. (2002) and Vonesh (1998).

**Table 5.3.** List of amphibians and reptiles collected in Misotshi-Kabogo Forest.

|                                            |
|--------------------------------------------|
| <b>Amphibia</b>                            |
| <b>Arthroleptidae</b>                      |
| <i>Arthroleptis</i> sp.                    |
| <i>Leptopelis kivuensis</i> Ahl            |
| <b>Hyperolidae</b>                         |
| <i>Afrivalus laevis</i> Ahl                |
| <i>Hyperolius argentovittis</i> Ahl        |
| <i>Hyperolius</i> sp. 1                    |
| <i>Hyperolius</i> sp. 2                    |
| <i>Hyperolius</i> sp. nov.                 |
| <i>Hyperolius castaneus</i> Ahl            |
| <b>Pyxicephalidae</b>                      |
| <i>Amietia angolensis</i> (Bocage)         |
| <b>Phrynobatrachidae</b>                   |
| <i>Phrynobatrachus</i> sp. nov.            |
| <i>Phrynobatrachus</i> sp.                 |
| <b>Reptilia</b>                            |
| <b>Chamaleonidae</b>                       |
| <i>Rhampholeon boulengeri</i> Steindachner |
| <b>Colubridae</b>                          |
| <i>Dipsadoboa unicolor</i> Günther         |
| <b>Elapidae</b>                            |
| <i>Naja melanoleuca</i> Hallowell          |
| <b>Viperidae</b>                           |
| <i>Atheris nitschei</i> Tornier            |

Comments on the list of species collected:

**Reptiles:**

*Atheris nitschei* and *Rhampholeon boulengeri* are Albertine Rift endemics and this adds an additional endemic reptile to the list for Misotshi-Kabogo. *Dipsadoboa unicolor* and *Naja melanoleuca* are Guineo-Congolian species.

**Amphibians**

The Identification of the species belonging to the genus *Arthroleptis* are always difficult because the species boundaries are very poorly defined. For some species groups revision based on DNA are ongoing. Care must therefore be taken when identifying this group and it takes time to identify them to species. Some *Hyperolius* are also hard to identify and as yet only two of the species have been identified.

Two specimens of a large *Hyperolius* are not fitting the description of any known species and are likely to belong to an undescribed taxon. Further analyses are necessary to assess their taxonomic status.

One of the specimens initially looked like a *Phrynobatrachus*. After further analysis, because of the apparent lacking of the tarsal tubercle that is diagnostic for *Phrynobatrachus*, it was tentatively assigned to the genus *Petropedetes* on the

ground of some morphological features and also because there is some evidence of the possible presence of an undescribed *Petropedetes* species in the albertine area based on some tadpoles collected by Drewes in the Impenetrable forest (Drewes & Vindum, 1994). However, after taking x rays of the terminal phalanges of the fingers of these frogs traces of the tarsal tubercles were found in some specimens and based on this evidence the final opinion is that the material collected belong to an undescribed large-sized *Phrynobatrachus* (thus not *Petropedetes*).

There are therefore likely to be at least two new amphibian species for science, one *Phrynobatrachus* and one *Hyperolius*.

## Discussion

Eighty specimens of amphibians and five reptiles were collected in the Misotshi-Kabogo forest during a two month period of surveys. It appears that two of the amphibians are new to science. In addition four new amphibian species for the list for this region were added and two new reptile species.

Previous collections focused on the western side of the massif around the hill called Kabobo and to the west towards the road linking Kalemie to Uvira. The collections in this survey were made around the camps B, B2 and C1, C2 and C3 and therefore covered only a small area of the massif during only one season. It is very likely that with further collecting effort that more species would be identified for the forest as only a fraction of the list provided by the Africa Museum in Tervuren were found. We therefore believe that it is likely further new species for science could be found.

The data to date show that at least 14 amphibian species occur in the Misotshi-Kabogo forest block and 26 reptile species. Seven of the amphibians endemic to the Albertine Rift have been identified for this forest block with a possible two additional species to be added if they are proved to be new species. Two endemic reptile species are also known from the region. Only five other sites (Bwindi Impenetrable Park, Virunga Park, Itombwe Massif, Kahuzi Biega Park and Nyungwe Park) have more endemic amphibians. In addition one species that occurs here is endangered and four others vulnerable under IUCN threatened status criteria. It is probable that the two new species should deserve a threatened status. Misotshi-Kabogo therefore appears to be fairly important for amphibian conservation.

## CHAPTER 6: Botanical Surveys

B. Kirunda, A.J.Plumptre, J.Kyamanywa and G. Bashonga

### Introduction

Plants have been surveyed over large parts of the Albertine Rift Forests and hence are useful when wanting to make comparisons of the diversity between sites. Plants are also much more sessile and hence more likely to evolve into different species when isolated for long periods in geological history. It is thought that the Misotshi-Kabogo massif has been isolated from the Itombwe Massif to the north for at least 10,000 years (Progogine, 1960) and therefore we expected to find some interesting plant species in this region.



Although plants have been collected throughout eastern DR Congo and there are probably collections from the Misotshi-Kabogo and Muganja Hills regions the specimens are housed in museums and we do not know of any compiled lists for this area. As a result it is difficult to assess the importance of the region botanically.

We therefore created two teams of botanists to collect all flowering plants and ferns from the various camps visited in the two areas with the aim of creating species lists for the two sites.

### Methods

Two methods were used to obtain both qualitative and quantitative data for plants at each camp. Firstly the botanical teams collected any plant that they encountered at each site and when working from the camps. The aim of this was to create a species list for each camp. Secondly plants were recorded and counted in plots situated at the same points every 250 metres along the transect/reconnaissance routes that were used by the large mammal, and the ornithology teams. All herbs were recorded in a 2 metre radius circular plot; all lianas over 1cm DBH, and all trees between 2.5-10.0 cm DBH recorded in a 5 metre radius plot; and all trees larger than 10.0 cm DBH recorded in a 20 metre radius plot in diameter categories. The aim of the second method was to provide quantitative data to identify the dominant species, and relative abundance of different species and also to allow comparisons with other forests in the Albertine Rift.

Two teams were formed that worked at all sites in the Misotshi-Kabogo Forest. It was not possible to keep these teams for the Muganja Hills region because of financial reasons and therefore this area was not surveyed for plants.

Over 1000 specimens were collected in the forest and are in the process of being identified to species level. This will take several months, but given the imperative of highlighting the conservation importance of this area we summarise the species numbers below. It has been possible to sort the specimens to calculate a total number of plant species for each camp site and this is what we present here.

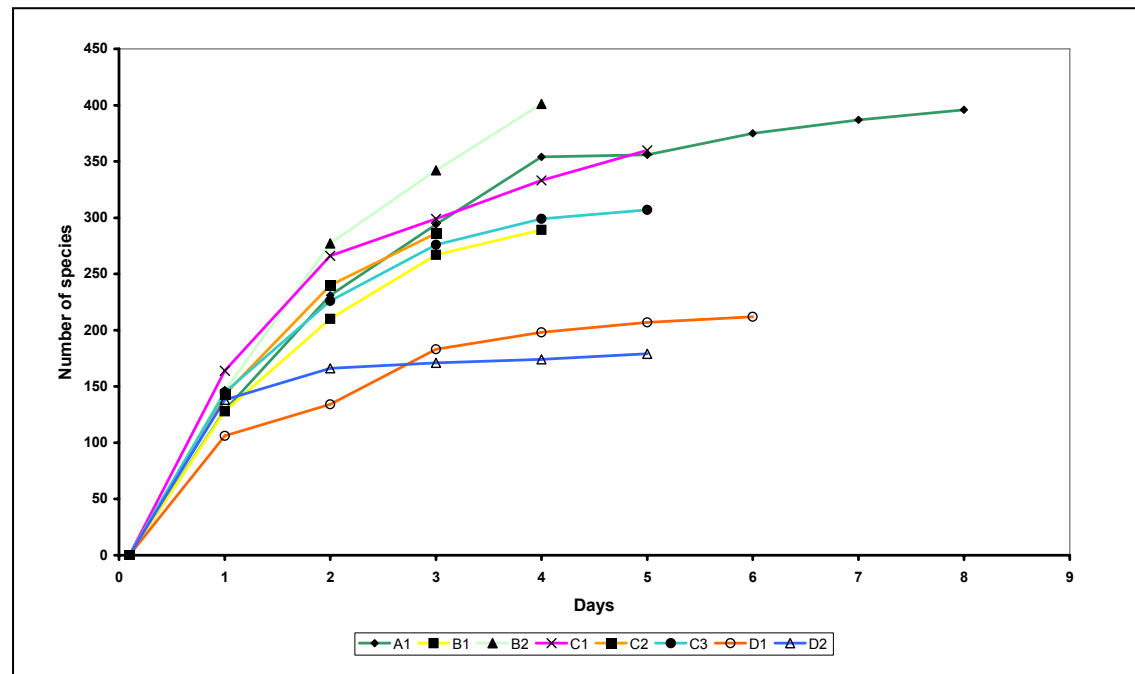
## Results

We have not yet calculated the total number of species for the forest as a whole but we do have numbers of species for each camp by plant types and total number of species (Table 6.1).

**Table 6.1.** The total number of plant specimens for each camp in various categories of plant type. Some species were not classified as a plant type and hence the total number of species exceeds the sum of the different plant types.

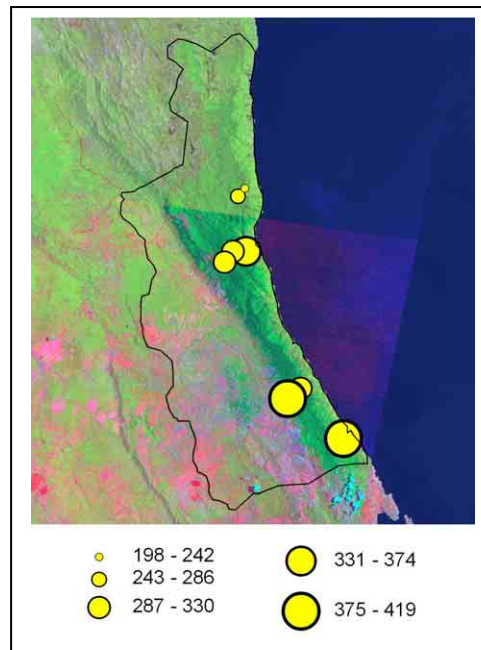
| Plant type   | A1         | B1         | B2         | C1         | C2         | C3         | D1         | D2         |
|--------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Fern         | 22         | 26         | 22         | 38         | 40         | 27         | 33         | 15         |
| Grass        | 6          | 6          | 30         | 4          | 6          | 25         | 1          | 1          |
| Herb         | 45         | 75         | 131        | 75         | 90         | 141        | 61         | 20         |
| Liana        | 49         | 43         | 52         | 65         | 42         | 26         | 29         | 34         |
| Shrub        | 65         | 80         | 92         | 89         | 46         | 58         | 27         | 38         |
| Tree         | 144        | 57         | 69         | 81         | 56         | 29         | 47         | 60         |
| <b>Total</b> | <b>396</b> | <b>289</b> | <b>401</b> | <b>360</b> | <b>286</b> | <b>307</b> | <b>212</b> | <b>179</b> |

The species accumulation curves show that camps B2, A1 and C1 are the more diverse sites (Fig. 6.1). A1 and C1 are lower altitude sites but B2 was a high altitude site which contained a mixture of forest and grassland.



**Figure 6.1.** Species accumulation curves for plant species collected at each camp site using total list data.

The relative abundance of plant species is plotted in figure 6.2 and shows that plant diversity was high at low altitudes or where there were several major habitat types.



**Figure 6.2.** The relative abundance of plant species mapped for the Misotshi-Kabogo forest block.

### Discussion

Although still very preliminary the results presented here show that this forest is rich in plant species. Given the diversity of birds, amphibians and mammals and that there are several species or subspecies in these groups from this area we expect to find new species of plant amongst the samples we have. The botanists who collected the specimens, and who have worked in most of the other forests in the Albertine Rift, found many species they could not identify immediately and we therefore believe that it is probable that there are new species. Those that cannot be identified will be sent to the Royal Botanic Gardens at Kew or Meise in Belgium which has much of the Congo collections. At present this appears to be about 10% of the 1000+ samples collected.

An updated list will be published in future and we aim to list these on the Albertine Rift web site ([www.albertinerift.org](http://www.albertinerift.org)).



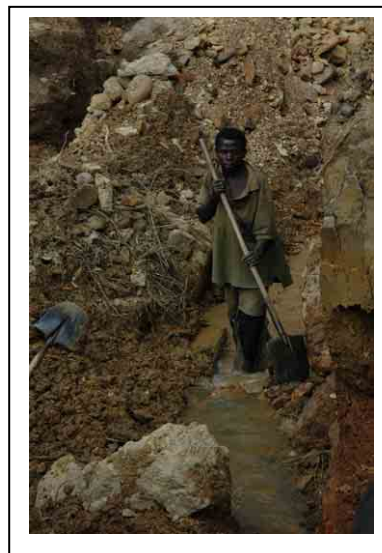
## **CHAPTER 7: Impacts of man and the future conservation of Misotshi-Kabogo and Muganja Hills regions**

**A.J.Plumtre and D.Kujirakwinja**

### **Introduction**

It is clear from the biodiversity survey work and the estimate of chimpanzee numbers that the Misotshi-Kabogo region is of conservation importance. The Muganja hills was not so diverse from the bird and mammal surveys made there and may only be of conservation interest if the chimpanzees in this region proved to be different to those north of the Lukuga river. In this chapter we assess some of the threats to both regions surveyed and also the potential for developing any form of conservation area in the Misotshi-Kabogo region.

We wanted to measure the presence of people in the two regions to allow us to better assess the potential for conservation of these two sites. If the areas were heavily populated for instance it would be very difficult to establish a conservation area.



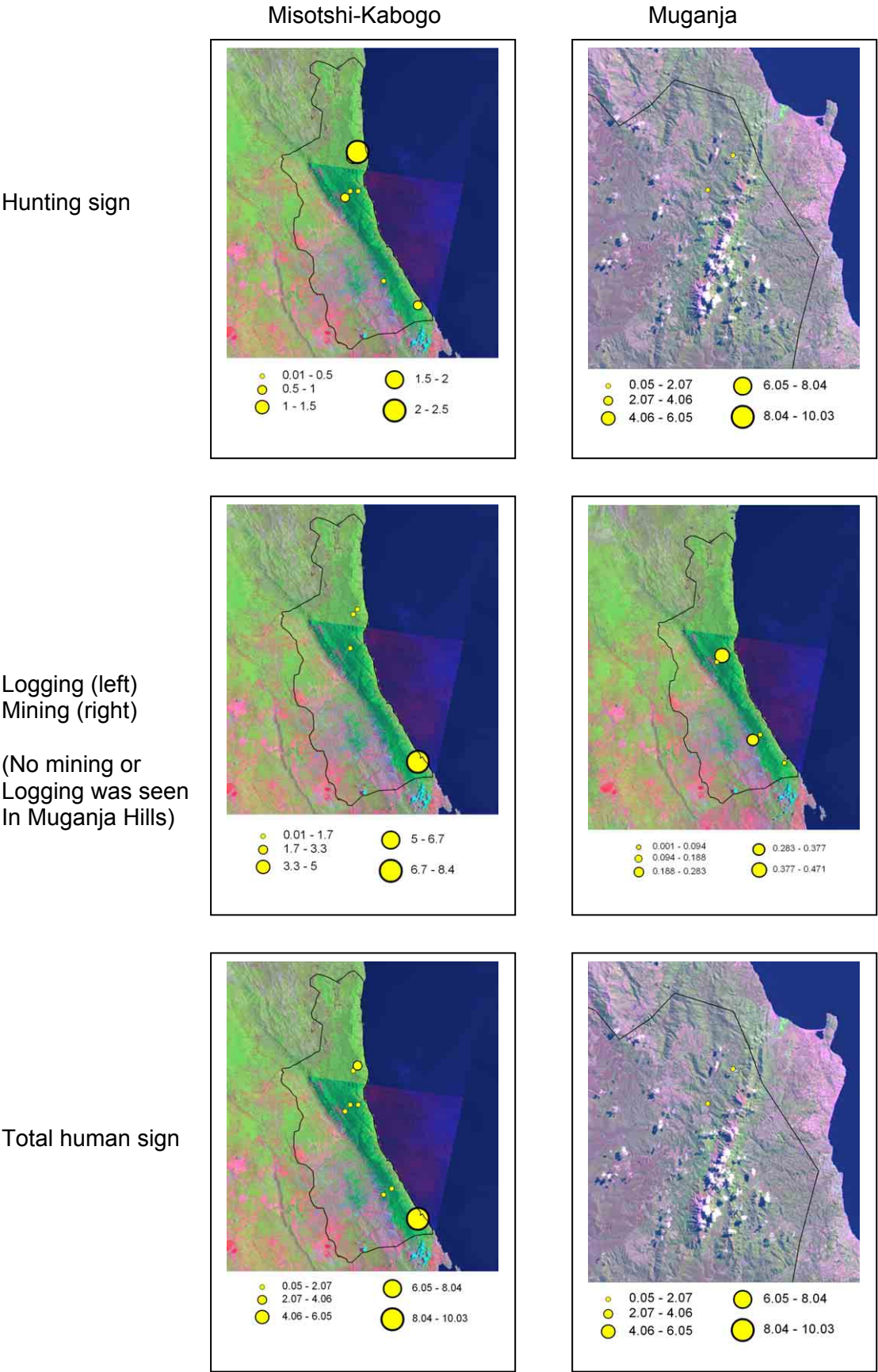
During the surveys we collected data on signs of human impact in the forest to provide a comparative assessment with other forests in the Albertine Rift. On the recce and transect walks any signs of human impact were noted and GPS positions taken. Human impacts included signs of hunting (snare and pitfall traps), logging (pitsawing sites, tree stumps), human use of the forest (huts, latrines, footpaths) and mining sites (gold mining disturbance). We calculated encounter rates for each type of human sign based on the measured distances walked (see chapter 2). The teams recording large mammal sightings and chimpanzee nests also recorded human sign as they traveled further than the other teams each day.

### **Results**

#### ***Human impacts in general***

Very little sign of human impact was observed in either region when compared with other areas in the Albertine Rift. Most of the human impacts occurred near the southern edge of the Misotshi-Kabogo region nearest to the town of Kalemie and from where people appear to be moving northwards to settle and cultivate. Most of the human impact in this region included timber harvesting (Figure 7.1). Deeper in the forest, artisanal gold mining was taking place, particularly at the highest altitudes. We interviewed miners and local villagers to obtain a better understanding of the mining activity as it was clear that this was one of the major threats to the Misotshi-Kabogo region. The results of these interviews are summarized below.

It was clear from the low density of primates and ungulate sign that hunting of large mammals was relatively common also. However, few signs of snares were found in the forest except near Misotshi mountain (camps D). Interviews with local people made it clear that there were a few hunters who regularly supplied the mining camps with meat using shot guns to hunt the mammals. Several of the people we hired to guide us in the forest were hunters and interviews with them indicated that they did not earn very much from hunting but mainly hunted to supplement what they obtained from their fields and fishing.



**Figure 7.1** Relative encounter rates of different human sign in the Misotshi-Kabogo and Muganja Hills regions. Both maps are plotted to the same scale.

We were told that hunting of chimpanzees was a taboo in the Babembe culture which probably is why this species appears to be relatively abundant and occurs at densities similar to those at other sites in the Albertine Rift where hunting doesn't occur. However, other ethnic groups which are moving into the area to mine for gold were hunting this species occasionally and we were shown skins and body parts of chimpanzees at some villages.

There were no permanent villages or settlements that we could identify within either region, only temporary mining settlements and military camps. The only villages in the Misotshi-Kabogo region occurred along the lake shore and the people were mostly fishermen, fishing for themselves with little trade to other villages or towns.

### **Gold mining**

Most of the miners operating in the forest came from Bukavu region and not from the villages along the lake shore. Historically the Belgians had explored this region in the 1950s and people remembered a Belgian man who camped in the forest near the higher altitudes and collected gold from various sites (hiding the gold in a pit under his tent which can still be seen today). Following independence in 1960 Joseph Kabila started a business of mining gold in the forest and exporting it to Tanzania to support his rebellion in the region. This mining continued throughout the 1960s and 1970s until he was ousted from the forest in 1980. As a result most of the people living in the fishing villages stated that there is little gold to be found these days and although several of the people we employed had tried mining at one time, they had given it up because the rewards were so poor. The miners from Bukavu stated that they walk from Bukavu to Misotshi-Kabogo (about a 4 day walk – 300 km in a direct line) because they have been robbed in the past when carrying gold. Some had been living in the forest away from their families for many years – one had been there for 20 years and still had not found a major strike. One of the reasons they mine in this region is because it is not a protected area and they are less likely to face problems from ICCN rangers (compared to miners in Kahuzi Biega Park which is close to Bukavu).

Many miners stated they sell the gold they collect to middle men who export the gold and probably make most of the profit. We met some of these middle men who hike up to the camps from the lake shore. Those we met came from Kalemie or Uvira. Those people who had given up mining stated that they only made about \$20-40 per month from mining and that they didn't believe it was worth the hardship.

The village chiefs from the villages on the lake did not view the miners from Bukavu with any great fondness although all of them pay these chiefs to be allowed to mine in their sector of the forest. There is some local trade in fish and maize flour between the fishing villages and the mining camps which probably boosts the economy of the fishing villages to some extent also. However, this economy is likely to be small.

### **Conservation options**

It is clear from the results of the biodiversity surveys that the Misotshi-Kabogo forest block is important globally for conservation. We believe we may have three new mammal species and two new frog species for the world after only a short survey period and hence it is possible that other species may occur here. Chimpanzees were relatively abundant in the forest and we estimate that a viable population still exists in the Misotshi-Kabogo region. Hair samples were collected for this species for genetic analyses and this may throw light on the relative differences that occur within *P.t. shweinfurthii* in this region. Unfortunately we were unable to collect any hair samples from the Muganja hills, despite our desire to obtain some samples because

these animals are found south of the Lukuga river. With follow-up visits to the region we hope we will be able to obtain some fresh hairs in future.

We believe therefore that the forest is worthy of some form of protected status. In DR Congo there are several protected area categories including National Park, Faunal Reserve and Community Reserves. At each of the fishing villages we visited we discussed the idea of possibly creating some type of protected area, but emphasizing that this would only be made with consultations with the local communities. In general most of the local chiefs were positive towards this idea, particularly if they were consulted as part of the process and several offered to try to stop hunting in the areas under their jurisdiction. When asked why they were positive they told us that they believed that a protected area would bring a 'spotlight' to their part of the world, which has been neglected for over 50 years, and that it could bring development possibilities in future.

We therefore believe that it is both important to create a protected area of some form in the Misotshi-Kabogo region but we are less sure that the Muganja Hills region deserves this. We also believe that it would be possible to obtain local support fairly easily given our discussions with people living around Misotshi-Kabogo. The main issue that would need to be resolved is the possibility of funding the conservation of this area on a longer term basis such that the local people obtain some benefits that would offset what they would lose through the loss of earnings from portering supplies and selling food to mining camps.

Access to the forest from the lake is very hard – at least a 4-5 hour hike on very steep hills for fit people and probably twice this for an average tourist. Once at the higher altitudes though the forest-grassland mosaic is very beautiful and has potential for tourism (Photo 3 – chapter 1). It may be possible to access this area from the Kalemie-Uvira road more easily, particularly if the old road to the Kabobo hill region was opened up. There might also be potential for horse riding safaris in the grassland-forest mosaic to the west of the massif and up the escarpment to the western side of the forest if an investor could be identified to invest in this. We observed chimpanzees, bushbuck, red forms of bush pig and signs of other large mammals using these areas despite relatively intensive hunting and with protection it could become a beautiful place to view wildlife. It might also be possible to develop a tourism circuit based on lake Tanganyika that would visit four main sites on the lake: Gombe Stream National Park, Mahale Mountains National Park (both to visit chimpanzees) and then across to the Misotshi-Kabogo region for trekking/horse riding safaris and up to Burton Bay where it is proposed to create a park on Lake Tanganyika. The diversity of fish makes snorkeling and diving a great possibility for this area.

Other options for funding the conservation of this forest that don't involve tourism could include avoided deforestation under a Carbon sequestration/credit scheme. Companies are looking for areas which might be deforested in the near future that they could obtain carbon credits from paying to prevent their deforestation and the Misotshi-Kabogo region could provide about 1,200 km<sup>2</sup> of forest for such a scheme.

The boundary we have used for the Misotshi-Kabogo region in this report is where we believe a protected area might be created. It avoids any permanent settlements that we know about or could identify on satellite imagery and extends up to the road in the west which could form an obvious boundary. More surveys over this region are needed to better define the boundary limits and also an assessment needs to be made about possible linkages to the Luama Game Reserve that lies to the west of Misotshi-Kabogo.

### **Follow up needs**

If a protected area is to be created in the Misotshi-Kabogo region there needs to be some fairly rapid follow-up to these surveys. People are moving into the region from the south and north and over the next few years we would expect this to accelerate as peace comes to the region. It is clear that many of the local leaders viewed the potential of a protected area as a positive move and we believe that two main activities are now needed as follow up actions:

1. There is a need to bring together the local leaders from all the villages surrounding the potential protected area, provincial leaders from Kalemie, Lubumbasi and Uvira, and members from ICCN and Forest Department in Kinshasa to present the results of this survey and to discuss the idea of creating a protected area with everyone, and to allow their inputs and desires to be heard.
2. There is a need to survey the potential boundaries for a protected area and better delimit where it would occur on the ground in discussion with provincial authorities and local leaders. Initially it would be useful to map the region using aerial photography or high resolution satellite imagery to better identify where settlements occur in the region and to assess potential boundaries and natural features that could act as limits.

Once these are completed and provided that there is enough local support we believe it would be relatively easy to then proceed to create a protected area to conserve the rich biodiversity of this region.

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**Appendix 1.** List of bird specimens collected by the Field Museum of Chicago and effort required to make the collections. Below are collecting localities, summaries of mist-netting effort and lists of specimens collected during our surveys of Kabobo Forest, D. R. Congo. Please refer to the Transect/point count section for more complete bird lists. For detailed vegetational site descriptions see the Botanical Surveys.

*Camp 1: "Mizimu" Dem. Rep. of Congo, Katanga Province, Kabobo Forest, ca. 3km W Mizimu S 5° 28' 45"/E 29° 16' 42' 1250m.*

Table 1. Mist-net sampling effort at Mizimu (Camp A).

| Date            | Hours | Nets | Net hours     | Meter Net Hours |
|-----------------|-------|------|---------------|-----------------|
| 29 January 2007 | 6     | 12   | 72            | 864             |
| 30 January 2007 | 11.5  | 12   | 138           | 1656            |
| 31 January 2007 | 12    | 12   | 144           | 1728            |
| 1 February 2007 | 12    | 12   | 144           | 1728            |
| 2 February 2007 | 12.5  | 12   | 150           | 1800            |
|                 | 5     | 9    | 45            | 540             |
| 3 February 2007 | 11.5  | 9    | 103.5         | 1242            |
| 4 February 2007 | 12.5  | 9    | 112.5         | 1350            |
|                 | 6     | 12   | 72            | 864             |
| 5 February 2007 | 24    | 9    | 216           | 2592            |
|                 | 12    | 12   | 144           | 1728            |
| 6 February 2007 | 9     | 12   | 108           | 1296            |
|                 | 8.5   | 9    | 76.5          | 918             |
| <b>TOTAL</b>    |       |      | <b>1525.5</b> |                 |

Table 2. Bird voucher specimens collected at Mizimu (Camp A).

| Scientific Name                               | Common Name               | Male/Female (♂/♀) |
|-----------------------------------------------|---------------------------|-------------------|
| <i>Althe diademata woosnami</i>               | Fire-crested Alethe       | 1♀                |
| <i>Alethe poliocephala carruthersi/ufipae</i> | Brown-chested Alethe      | 5♂, 5♀            |
| <i>Bleda syndactyla woosnami</i>              | Red-tailed Bristlebill    | 1♂, 1♀            |
| <i>Nectarinia olivacea vincenti</i>           | Olive Sunbird             | 6♂, 2♀            |
| <i>Phyllastrephus fischeri sucosus</i>        | Cabanis Greenbul          | 4♂, 3♀            |
| <i>Platysteira concreta</i>                   | Yellow-bellied Wattle-eye | 5♂, 6♀            |
| <i>Pycnonotus masukuensis kakamegae</i>       | Shelly's Greenbul         | 1♂                |
| <i>Pycnonotus virens virens</i>               | Little Greenbul           | 2♂, 4♀            |
| <i>Pycnonotus latirostris eugenius</i>        | Yellow-whiskered Greenbul | 1♂, 7♀            |
| <i>Stizorhina fraseri</i>                     | Frasers Ant-thrush        | 1♂                |
| <i>Trichastoma fulvescens ugandae</i>         | Brown Illadopsis          | 2♂, 1♀            |
| <i>Trichastoma albipectus</i>                 | Scaly-breasted Illadopsis | 1♂                |

Camp 2. "Talama 1" Dem. Rep. of Congo, South Kivu Province, Kabobo Forest, ca. 4km SW Talama. 1950m.

Table 3. Mist-net sampling effort at Talama 1 (Camp D1).

| Day          | Hours | Nets | Net Hours   |      |
|--------------|-------|------|-------------|------|
| 1            | 10    | 12   | 120         | 1440 |
| 2            | 12    | 12   | 144         | 1728 |
| 3            | 12    | 12   | 144         | 1728 |
|              | 4     | 8    | 32          | 384  |
| 4            | 24    | 20   | 480         | 5760 |
| 5            | 24    | 20   | 480         | 5760 |
| 6            | 11    | 20   | 220         | 2640 |
| <b>TOTAL</b> |       |      | <b>1620</b> |      |

Table 4. Bird voucher specimens collected at Talama 1 (Camp D1).

| Scientific Name                                     | Common Name                | Male/Female (♂/♀) |
|-----------------------------------------------------|----------------------------|-------------------|
| <i>Alethe poliophrys kaboboensis</i>                | Red-chested Alethe         | 2♂, 8♀            |
| <i>Apaloderma vitattum</i>                          | Bar-tailed Trogon          | 1♂                |
| <i>Batis diops</i>                                  | Rwenzori Batis             | 2♂, 1♀            |
| <i>Cercococcyx montanus</i>                         | Barred Long-tailed Cuckoo  | 1♀                |
| <i>Cossypha bocagei kaboboensis</i>                 | Bocage's Akalat            | 1♀                |
| <i>Cossypha roberti rufescentior</i>                | White-bellied Robin-chat   | 7♂, 1♀            |
| <i>Cossypha archeri kimbutui</i>                    | Archer's Robin-chat        | 1♀                |
| <i>Nectarinia alinae kaboboensis</i>                | Blue-headed Sunbird        | 6♂, 4♀            |
| <i>Nectarinia regia kivuensis</i>                   | Regal Sunbird              | 3♂, 1♀            |
| <i>Phyllastrephus flavostriatus olivaceogriseus</i> | Yellow-streaked Greenbul   | 3♂, 2♀            |
| <i>Phylloscopus laetus schoutedeni</i>              | Red-faced Woodland Warbler | 2♂                |
| <i>Pogonocichla stellata ruwenzori</i>              | White-starred Robin        | 4♂, 2♀            |
| <i>Pycnonotus masukuensis kakamegae</i>             | Shelly's Greenbul          | 6♂, 3♀            |
| <i>Pycnonotus tephrolaemus kikuyuensis</i>          | Mountain Greenbul          | 7♂, 4♀            |
| <i>Pycnonotus latirostris eugenius</i>              | Yellow-whiskered Greenbul  | 7♂, 3♀            |
| <i>Sylvietta leucophrys chloronota</i>              | White-browed Crombec       | 1♂                |
| <i>Trichastoma pyrrhopterum pyrrhopterum</i>        | Mountain Illadopsis        | 2♂, 1♀            |
| <i>Trichastoma poliothorax</i>                      | Gray-chested Illadopsis    | 2♂                |
| <i>Trochocercus albonotatus albonotatus</i>         | White-tailed Elminia       | 1♂, 1♀            |
| <i>Zoothra tanganjicae</i>                          | Abyssinian Ground Thrush   | 1♂, 1♀            |

Talama 2: Dem. Rep. of Congo, South Kivu Province, Kabobo Forest, ca. 4km SW Talama. S 4° 59' 05"/E 29° 05' 34' 1600m.

Table 5. Mist-net sampling effort at Talama 2 (D2).

| Day          | Hours | Nets | Net Hours  |      |
|--------------|-------|------|------------|------|
| 1            | 11.5  | 8    | 92         | 1104 |
| 2            | 11    | 8    | 88         | 1056 |
| 3            | 4     | 4    | 16         | 192  |
| 4            | 24    | 8    | 192        | 2304 |
| 5            | 23.5  | 4    | 94         | 1128 |
| 6            | 24    | 10   | 240        | 2880 |
| 7            | 6     | 10   | 60         | 720  |
| <b>TOTAL</b> |       |      | <b>782</b> |      |

Table 6. Bird voucher specimens collected at Talama 2 (Camp D2).

| Scientific Name                                     | Common Name               | Male/Female (♂/♀) |
|-----------------------------------------------------|---------------------------|-------------------|
| <i>Alethe poliophrys kaboboensis</i>                | Red-chested Alethe        | 5♂, 3♀            |
| <i>Alethe poliocephala carruthersi/ufipae</i>       | Brown-chested Alethe      | 1♂, 2♀            |
| <i>Bleda syndactyla woosnami</i>                    | Red-tailed Bristlebill    | 1♂, 1♀            |
| <i>Cossypha bocagei kaboboensis</i>                 | Bocage's Akalat           | 3♂, 1♀            |
| <i>Cossypha natalensis intense</i>                  | Red-capped Robin-chat     | 1♂♀               |
| <i>Nectarinia olivacea vincenti</i>                 | Olive Sunbird             | 4♂, 1♀            |
| <i>Phyllastrephus flavostriatus olivaceogriseus</i> | Yellow-streaked Greenbul  | 2♂, 2♀            |
| <i>Pycnonotus virens virens</i>                     | Little Greenbul           | 1♂                |
| <i>Pycnonotus latirostris eugenius</i>              | Yellow-whiskered Greenbul | 9♂, 6♀            |
| <i>Pycnonotus tephrolaemus kikuyuensis</i>          | Mountain Greenbul         | 7♂, 4♀            |
| <i>Zosterops senegalensis reichnovii</i>            | African White-eye         | 1♀                |