Amphibians and Reptiles of Lokutu

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A Rapid Biological Assessment of Lokutu, Democratic Republic of Congo

Thomas M. Butynski and Jennifer McCullough (Editors)

RAP Bulletin of Biological Assessment 46

Center for Applied Biodiversity Science (CABS)

Conservation International

Conservation International—Central Africa Program

Institut Congolais pour la Conservation de la Nature (ICCN)

Cover photos

[Top]: Adult male De Brazza's monkey (*Cercopithecus neglectus*). This is one of the species of primate that continues to occur in the vicinity of Lokutu, Democratic Republic of Congo. Photo © Harald Schuetz.

[Center]: A male butterfly (*Cynandra opis*), at Lokutu, Democratic Republic of Congo. Photo © Brian Finch.

[Bottom]: An adult green bush viper (*Atheris squamiger*) captured by local hunters near the Lukumete camp site. Photo © Johannes Penner.

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Conservation International (CI) is an international, non-profit organization based in Arlington, VA. CI believes that the Earth's natural heritage must be maintained if future generations are to thrive spiritually, culturally and economically. Our mission is to conserve the Earth's living heritage, our global biodiversity, and to demonstrate that human societies are able to live harmoniously with nature.

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ICCN, created in 1975, is a public institution providing technical and scientific support to the Democratic Republic of Congo. The mandate of ICCN is to: 1) manage and conserve the biodiversity of protected areas, 2) promote scientific research and ecological development, 3) develop ecotourism with respect to the fundamental principles of the Conservation of Nature, and 4) integrate conservation into local development processes in human populations along rivers in protected areas. ICCN believes that the protection of nature and its conservation for future generations is not only an important task for the Congolese, but also an obligation for the international community to preserve the genetic resources of the unique flora and fauna for all of humanity.

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We thank the RAP scientists, Tom Butynski, K.-D. Dijkstra, Brian Finch, Quentin Luke, Johannes Penner and Jim Sanderson, for their inspiring hard work in the field and for maintaining a sense of humor under difficult conditions. Tom Butynski led the six person scientific team. Jim Sanderson and Karl Morrison assisted in transporting RAP equipment. Karl Morrison looked after the team on its departure from Kinshasa. Johannes Penner arranged the export permits at the last minute. Yvonne A. de Jong compiled the map of the Lokutu area. Ole Müller allowed the reproduction of his *Zygonoides* drawings (Figure 3.6).

Conservation International (CI) supported this RAP survey in many ways. Leeanne E. Alonso and Jennifer McCullough facilitated and supported planning for the RAP expedition. Jennifer McCullough led preparation of this report. CI's Central Africa Program, especially Juan Carlos Bonilla, Karl Morrison, Ian Dodds and Sarah Banks, helped to make this RAP possible. Leslie Kasmir of the RAP program assisted in logistical coordination. CI's Finance department provided essential assistance with financial logistics.

This RAP survey was generously funded as part of a grant from the United States Agency for International Development (USAID) to Conservation International to develop a strategy for conservation and development for the Lokutu Region in the Democratic Republic of Congo.

Report at a Glance

A RAPID BIOLOGICAL ASSESSMENT OF LOKUTU, DEMOCRATIC REPUBLIC OF CONGO

Expedition Dates

26 October – 8 November 2004

Area Description

Lokutu, within the Territory of Basoko in the Democratic Republic of Congo, lies on the southern boundary of the northern-most extent of the Congo River. At one time, the Lokutu area was completely covered with lowland moist forest. Today, the Lokutu area still contains forest, some within Unilever's Lokutu Oil Palm Plantation concession. The plantation has been cleared except for narrow strips of forest along streams and rivers, and two (ca. 50 km^2 each) forest blocks in the northwest of the concession. The Lokutu area is adjacent to the Maringa-Wamba-Lopori landscape, targeted for conservation and development activities under the Congo Basin Forest Partnership (CBFP). Despite the high conservation importance of this landscape, there are no formal protected areas in this region.

Expedition Objectives

The primary objective of this survey was to identify potential areas for long-term investment as part of Conservation International's biodiversity conservation program for the Congo Basin High Biodiversity Wilderness Area. A first short survey of the area around the village of Lokutu in September 2002 examined the opportunity of an involvement of CI into the logging and oil palm concession of Unilever. The purpose of this RAP survey was to investigate the conservation value of the Lokutu area. The RAP team examined selected taxonomic groups to determine the area's biological diversity, its degree of endemism, and the uniqueness of the ecosystem. We chose to survey plants, odonates (dragonflies), amphibians, reptiles, birds, and larger mammals (with an emphasis on primates).

Overall Results

Due to permit restrictions, the RAP team was unable to access good forest for comparison to the Unilever plantation. Low species richness of all taxonomic groups, except dragonflies, was recorded within the plantation and nearby forest in the Lokutu area. High levels of forest degradation and fragmentation as well as hunting were widely documented.

Number of Species Recorded

Plants	574
Odonata (dragonflies)	86
Amphibians	21
Reptiles	6
Birds	204
Large mammals	14
Primates	6
Total	915

New Species Discovered

Odonata (3)

Mesocnemis sp.
Platycypha sp.
Elattoneura sp.

New Records for the Democratic Republic of Congo

Odonata (4)

Ceriagrion ignitum
Pseudagrion simplicilaminatum
Phyllogomphus coloratus
Chlorocypha pyriformosa

Amphibians (3)

Cardioglossa gratiosa
Amnirana amnicola
Dimorphognathus africanus

CONSERVATION RECOMMENDATIONS

Given the great loss of biodiversity, increasing human population, the apparent lack of interest or will by central and local government to manage the use of the natural resources, and the high costs of working in the area, the RAP team concluded that the Lokutu area is not a priority site for conservation investment or action. The RAP team also does not recommend that Lokutu be considered part of CI's Congo Basin High Biodiversity Wilderness Area.

If conservation funds are specifically earmarked for mitigating the negative conservation situation at Lokutu, there are some actions that could be taken. These include:

- Establishing active, long-term family planning and conservation education programs,

- Putting into place large community-protected and community-managed conservation areas, together with bushmeat hunter cooperatives, that would allow for recovery of wildlife populations and their sustainable exploitation,

- Re-establishing the livestock industry with the aim of providing substitutes for a portion of the bushmeat that is presently consumed.

An additional conservation recommendation of this report is that all necessary permits be obtained from the central, regional and local government authorities and additional surveys be undertaken in the forests located > 40 km to the south of Lokutu, as well as on both sides of the Congo River near Lokutu.

Executive Summary

INTRODUCTION

Because of their high biological diversity and uniqueness, African rainforests are a top global conservation priority (Olson and Dinerstein 1998, Kamdem-Toham et al. 2003, Mittermeier et al. 2004). Forest destruction has been fueled by rapid population growth and also by extensive road building which have greatly increased access to forests (Wilkie and Laporte 2001). The total harvest of wildlife in the Afrotropical region is estimated to be about 5 million tons annually, making this the most intensively hunted tropical region in the world (Fa et al. 2002). Recurring wars, political instability, disease, and endemic corruption have also created serious impediments for African forest conservation. While well over half of all of Africa's rainforests have been cleared and fragmented, Central Africa retains almost 60% of the original forest cover (Naughton-Treves and Weber 2001).

The Congo Basin Forest comprises the second largest block of tropical rainforest remaining on Earth. The majority of the Congo Basin Forest lies within the Democratic Republic of Congo (DRC), the third largest country in Africa, covering some 2,344,000 km² at the center of the continent. DRC is the single most biologically rich country in Africa, and, in terms of species richness, is near the top of the list for Africa for virtually every group of organisms. DRC harbors important communities of megafauna and, resulting from its proximity to the second largest river system on Earth, the Congo, DRC also holds a diverse freshwater fish fauna. Conservation International (CI) has identified the Congo Basin Forest as one of the world's High Biodiversity Wilderness Areas and, as such, a global biodiversity conservation priority.

Lokutu

Lokutu, within the Territory of Basoko, DRC, lies on the southern boundary of the northern-most extent of the Congo River (see Map). The Lokutu area still has forests, some of them within Unilever's Lokutu Oil Palm Plantation concession. Lokutu Oil Palm Plantation concession (630 km^2) is an active plantation of which ca. 100 km^2 are covered with oil palm (and some cocoa and coffee). The remaining ca. 530 km^2 are lightly to heavily disturbed. At one time, the Lokutu area was completely covered with lowland moist forest (Grainger 1996). The Plantation has been cleared except for narrow strips of forest along streams and rivers, and two (ca. 50 km^2 each) forest blocks in the northwest of the concession. These two blocks, as well as the forests surrounding the plantation, have been selectively logged. Lokutu Plantation employs ca. 1,900 people. The total population of the Lokutu area is ca. 10,000 people.

Lokutu is located in the northeastern section of the region south of the Great Bend of the Congo River, sometimes referred to as the *Cuvette Centrale*. This is also adjacent to the Maringa-Wamba-Lopori landscape, targeted for conservation and development activities under the Congo Basin Forest Partnership (CBFP). Despite the high conservation importance of this landscape, there are no formal protected areas in this region.

RAP EXPEDITION OVERVIEW AND OBJECTIVES

The primary objective of this RAP survey was to identify potential areas for long-term investment as part of Conservation International's biodiversity conservation program for the Congo Basin High Biodiversity Wilderness Area.

A first short survey of the area around the village of Lokutu in September 2002 examined the opportunity of an involvement of CI into the logging and oil palm concession of Unilever. The purpose of this RAP survey was to investigate the conservation value of the Lokutu area. The specific aims of the expedition were to:

- Derive a brief but thorough overview of species diversity within the Lokutu area and evaluate the area's relative conservation importance;
- Undertake an evaluation of threats to this biodiversity;
- Provide management and research recommendations for this area together with conservation priorities; and
- Make RAP data publicly available for decision-makers as well as members of the general public in the DRC and elsewhere, with a view to increasing awareness of this ecosystem and promoting its conservation.

The RAP expedition's team of six scientists comprised international scientists specializing in Central Africa's terrestrial ecosystems and biodiversity. The RAP team examined selected taxonomic groups to determine the area's biological diversity, its degree of endemism, and the uniqueness of the ecosystem. RAP expeditions survey focal taxonomic groups as well as indicator species, with the aim of choosing taxa whose presence can help identify a habitat type and its condition. We chose to survey plants, odonates (dragonflies), amphibians, reptiles, birds, and larger mammals (with a focus on primates).

STUDY AREA

We conducted surveys during the dry season in forests within and near Unilever's Lokutu Oil Palm Plantation concession. The surveys were conducted over 14 days (26 October – 8 November, 2004). Surveys focused mainly on four forest sites (see Map, Table 1.1).

SUMMARY OF RESULTS

Criteria generally considered during RAP surveys in order to identify priority areas for conservation across taxonomic groups include species richness, species endemism, rare and/or threatened species, and critical habitats. Measurements of species richness can be used to compare the number of species per area among areas within a given region. Measurements of species endemism indicate the number of species endemic to some defined area and give an indication of both the uniqueness of the area and the species that will be threatened by degradation or loss of that area's habitats (or conversely, the species that will likely be conserved through protected areas). Assessment of rare and/or threatened species that are known or suspected to occur within a given area provides an indicator of the importance of the area for the conservation of biodiversity. The presence or absence of such species also aids assessment of their conservation status. Many species listed on the IUCN Red List (IUCN 2006) carry increased legal protection, thus giving greater importance and weight to conservation decisions. Describing the number of critical habitats or subhabitats within an area identifies sparse or poorly known habitats within a region that contribute to habitat variety and, therefore, to species diversity. The following is a summary, based on these criteria, of the key findings from our field study.

Plants

A total of 485 taxa of indigenous plants and 89 taxa of exotic plants were recorded. The low botanical diversity of the palm plantations is compared with almost primary forest. The most interesting of the timber species was *Pericopsis elata* or Afrormosia. Considering that the Kisangani area is considered to be the last stronghold of this species, the very low stocking rate noted during this survey suggests that the situation is more serious than previously thought.

Odonates (Dragonflies)

A total of 86 taxa of odonates, mostly Guineo-Congolian running-water species, were found. There were several remarkable range extensions, as well as new species of *Platycypha*, *Elattoneura* and *Mesocnemis*. The species richness for odonates in this area is high, especially since only 24 (28%) species are widespread Afrotropical species; the remaining 62 (72%) are Guineo-Congolian species. Of the Guineo-Congolian group, 47% of the species occur almost throughout the Guineo-Congolian realm (i.e., well into West Africa), but the other 53% are more localized, restricted to the forested center of the continent. Thirteen of the species (almost one in six) have yet to be found outside the Congo Basin. The RAP results indicate a healthy watershed in the Lokutu area, with limited degrees of pollution and streambed erosion. If forest cover and natural stream morphology are retained, the rich dragonfly fauna is expected to persist. The species list is especially long considering the paucity of stagnant water species and the absence of certain Congolian endemics. The observed richness is probably typical of the Congo Basin as a whole and other areas are expected to be even richer. Therefore, the Lokutu area does not require specific conservation action as concerns the conservation of the odonate fauna.

This RAP survey demonstrated that it is possible to rapidly obtain a clear picture of odonate diversity, even

allowing a partial description of their ecology. The rich and apparently largely natural odonate fauna found contrasts with the impoverished status of the other taxonomic groups studied. Therefore, it is recommended to use odonates more frequently to supplement biodiversity assessments of the more traditional taxonomic groups, especially in the Congo Basin, where sampling odonates may show whether existing conservation priorities also protect watersheds and freshwater biodiversity.

Amphibians and Reptiles

Twenty-one species of amphibians and 16 species of reptiles were identified. Most species were common savannah or forest species that can adapt to a high level of anthropogenic disturbance. The known distributional range for six amphibian species (*Afrixalus equatorialis*, *Amnirana amnicola*, *Cardioglossa gratiosa*, *Dimorphognathus africanus*, *Hyperolius* cf. *lateralis* and *Leptopelis ocellatus*) was extended. Given the circumstances of this RAP survey (i.e., inaccessibility of potentially pristine forest patches), the species list reported here does not allow for meaningful conservation recommendations.

Birds

A total of 204 species of birds were found in the Lokutu area, of which 20 species are Palearctic migrants. No bird species listed as threatened on the 2004 IUCN Red List were encountered. We obtained geographic range extensions for 14 species and one subspecies. Previous logging activity, past and ongoing wide-scale conversion of forests to oil palm plantations and gardens, and heavy hunting pressure were documented. The findings indicate that the Lokutu area is of relatively low value as a site for the conservation of birds. This is due, in part, to a decline in the bird species richness of the site as a result of forest degradation, fragmentation, and clearance, together with unsustainable levels of hunting of some species. A preliminary list of the birds of the Lola ya Bonobo Sanctuary (near Kinshasa) is presented at the end of this report.

Mammals

Six species of primates and eight species of large mammals were recorded. Previous logging activity, ongoing wide-scale conversion of forests to oil palm plantations and gardens, and heavy hunting pressure were documented. Hunters claimed that they never observed large mammals such as African elephants, African buffaloes, leopards, or gracile chimpanzees (bonobos). The largest mammal present is the red river hog. The Lokutu area is of little conservation value for the conservation of primates and large mammals due to a considerable decline in the biological richness of the site and the collapse of the primate and large mammal communities. This situation has come about as a result of forest degradation, fragmentation, and clearance, together with unsustainable levels of hunting.

CONSERVATION CONCLUSIONS AND RECOMMENDATIONS

Given (1) the great loss of biodiversity and other conservation values, (2) the ever increasing human population and concomitant need to exploit the area's natural resources, (3) the lack of interest/will/ability, both of central government and local government, to control and manage the use of the natural resources, and (4) the high costs (both in terms of money and time) of working in the area, we do not find the Lokutu area to be a priority site for conservation investment or action — nor do we recommend that Lokutu be considered part of CI's Congo Basin High Biodiversity Wilderness Area. In other words, there are numerous other forests in equatorial Africa with a far more valuable biodiversity, and with far fewer threats, where much more conservation impact can be achieved for the funds and time invested.

Although the necessary permits were obtained from the various ministries in Kinshasa, the local authorities in the Lokutu area had little respect for this authorization, and actively sought out discrepancies — no matter how seemingly insignificant. Central Government has little or no authority in the Lokutu area. This opens the question as to the safety of any financial investment in the area. Based on the above, any investment in this area would be highly risky, not only as far as funding conservation actions is concerned, but also in support of the oil palm industry.

If, however, Unilever, or some other source (e.g., USAID), has conservation funds that can only be used for mitigating the negative conservation situation at Lokutu, there are some actions that could be taken. These include:

- Establishing active, long-term, family planning and conservation education programs,
- Putting into place large community-protected and community-managed conservation areas, together with bushmeat hunter cooperatives, that would allow for recovery of wildlife populations and their sustainable exploitation for bushmeat,
- Re-establishing the livestock industry with the aim of replacing a large portion of the bushmeat that is now eaten with beef, goat, sheep and poultry.

One of the original objectives of this RAP was to assess the biodiversity over a much wider area, more specifically, of the forests 40 km or more south of Lokutu. We were unable to accomplish this objective due to permit restrictions. Thus, we are unable to say in this report (1) how far south from Lokutu are found the nearest sites of high biodiversity value, (2) what impact the departure of Unilever from Lokutu might have on the survival of that biodiversity, or (3) what kind of conservation strategy would need to be put into place for the Lokutu area in order to conserve any

high biodiversity sites that might exist to the south. Thus, an additional conservation recommendation of this report is that all necessary permits be obtained from the central, regional and local government authorities and another survey of about one month be undertaken in the forests located > 40 km to the south of Lokutu.

The Congo River is one of Africa's great biological barriers and, as such, the floras and faunas on either side of this River are known to be substantially different. We recommend that more extensive biodiversity surveys be conducted on both sides of the River in the Lokutu area.

REFERENCES

Fa, J.E., C.A. Peres and J. Meeuwig. 2002. Bushmeat exploitation in tropical forests: an intercontinental comparison. Conservation Biology 16: 232–237.

IUCN. 2006. IUCN Red List of Threatened Species. www.iucnredlist.org

Kamdem-Toham, A., A.W. Adeleke, N.D. Burgess, R. Carroll, J. D'Amico, E. Dinerstein, D.M. Olson and L. Some. 2003. Forest conservation in the Congo Basin. Science 299: 346.

Mittermeier, R.A., P.R. Gil, M. Hoffman, J. Pilgrim, T. Brooks, C.G. Mittermeier, J. Lamoreux, G.A.B. da Fonseca. 2004. Hotspots Revisited. Cemex, Mexico City.

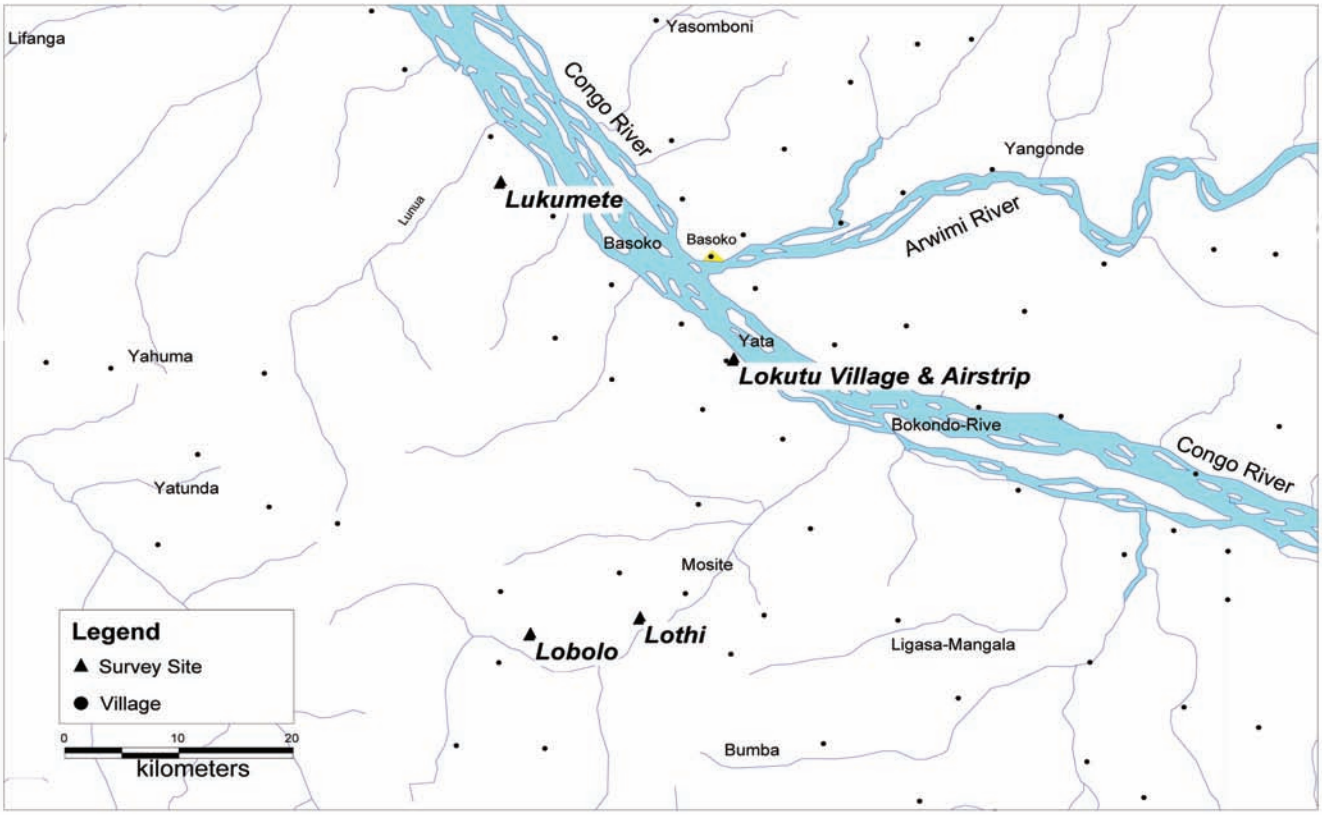
Naughton-Treves, L. and W. Weber. 2001. Human dimensions of the African rain forest. *In:* Weber, W., L.J.T. White, A. Vedder, N. Naughton-Treves (eds.). African Rain Forest Ecology and Conservation, pp. 20–46. Yale University Press, New Haven, CT.

Olson, D.M. and E. Dinerstein. 1998. The Global 200: a representation approach to conserving the earth's most biologically valuable ecoregions. Conservation Biology 12: 502–515.

Wilkie, D.S. and N. Laporte. 2001. Forest area and deforestation in Central Africa: current knowledge and future directions. *In:* Weber, W., L.J.T. White, A. Vedder, N. Naughton-Treves (eds.). African Rain Forest Ecology and Conservation, pp. 119–139. Yale University Press, New Haven, CT.

Maps

Map 1. The Democratic Republic of Congo, showing the location of Lokutu.
https://www.cia.gov/cia/publications/factbook/geos/cg.html



Map 2. Map of the Lokutu area, Democratic Republic of Congo, showing the locations of the four survey sites. See Table 1.1 for details. Map compiled by Yvonne A. de Jong.

Chapter 1

An Introduction to the RAP survey in the Lokutu Area, Democratic Republic of Congo

Jennifer McCullough

Tropical rainforests sustain a large portion of the world's biological diversity and are vanishing more rapidly than any other biome (Laurance 1999, Achard et al. 2002). In Africa, tropical rainforests are mainly confined to an equatorial belt of varying width as vegetation change is more strictly associated with latitude (Terborgh 1992). African vegetation zones roughly form a series of parallel bands across the continent that correspond to rainfall patterns. Evergreen forests occur in a narrow band along the coasts of West Africa and Central Africa, and across the Congo Basin into East Africa. Because of their high biological diversity and uniqueness, African rainforests are a top global conservation priority (Olson and Dinerstein 1998; Kamdem-Toham et al. 2003; Mittermeier et al. 2004).

Well over half of all African rainforests have been cleared and fragmented, mainly from slash-and-burn farming. Forest loss has been most severe in West Africa, which currently has <12% of its original rainforest (declining from 1.25 to 0.15 million km^2), and in eastern Africa, which has 8% of its original rainforest (declining from 0.36 to 0.03 million km^2). In contrast, Central Africa's forests still comprise almost 60% of their original distribution (Naughton-Treves and Weber 2001).

Forest destruction has been fueled by the rapid growth of human populations and also by extensive road building for logging, oil, mineral, and infrastructure projects, which have greatly increased access to forests (Wilkie and Laporte 2001). Additionally, the total harvest of wildlife in the Afrotropical region is estimated to be about 5 million tons annually, making it the most intensively hunted tropical region in the world (Fa et al. 2002). Recurring wars, political instability, disease epidemics, and endemic corruption are also serious impediments to forest conservation. In recent years, nearly one-third of the 42 sub-Saharan countries in Africa have been involved in international or civil wars. As one example, as a means of combatting rebels in the eastern half of the country, the Democratic Republic of Congo (DRC) (formerly Zaire) has bartered access to timber, gemstones, and minerals to Zimbabwe, Uganda, Rwanda, and Burundi in exchange for military support (Vedder et al. 2001).

The Congo Basin Forest, also referred to as the Lower Guineo-Congolian Forest, comprises the second largest block of tropical rainforest on Earth. The Congo Basin Forest extends from the coast of the Atlantic Ocean in the west to the Albertine Rift in the east, and spans the equator by nearly 7 degrees north and south. This forest block is one of two remaining regions on Earth that still boast large interconnected tracts of tropical rainforest.

Current biodiversity patterns in the Congo Basin date to the Pleistocene epoch (15,000–250,000 B.P.). The last great ice age, which peaked about 18,000 years ago, had a profound influence on biodiversity in this region. Cool, dry conditions existed at the equator during the peak of the ice age when much of North America and Europe were covered by a thick sheet of ice. The dry conditions in the tropics created isolated forested refugia. With repeated expansions and contractions of these forests during the Pleistocene, the flora and fauna experienced considerable isolation and speciation. These refugia included forested mountains to the west and east of the Congo Basin and vast swamps within the Congo Basin (Colyn et al. 1991; Maley 1996; White 2001). As the climate warmed and the ice cap receded, equatorial forests in

the Congo Basin and neighboring highlands greatly expanded to, once again, cover the Congo Basin.

The majority of the Congo Basin Forest lies within the Democratic Republic of Congo (DRC), the third largest country in Africa, covering some 2,344,000 km² at the center of the continent. Overall it is the single most biologically rich country in Africa, and, in terms of species richness, is near the top of the list for Africa for virtually every group of organisms. Evergreen forest canopy composition varies, from highly diverse mixed forests to forests dominated by one or a few tree species. Particularly noteworthy are the mono-dominant forests where a single species, *Gilbertiodendron dewevrei*, represents from 60% to over 80% of the canopy. DRC harbors important communities of megafauna, including gracile chimpanzee or bonobo (*Pan paniscus*), robust or common chimpanzee (*Pan troglodytes*), eastern gorilla (*Gorilla beringei*), forest elephant (*Loxodonta cyclotis*), and the okapi (*Okapia johnstoni*). DRC also has the second largest river system on Earth, the Congo, and one of the most diverse freshwater fish faunas. Conservation International (CI, Mittermeier et al. 2003) has identified the Congo Basin Forest as one of five High Biodiversity Wilderness Areas. As such, conservation of the Congo Basin Forest is a global biodiversity conservation priority.

Lokutu

Lokutu (formerly named 'Elizabetha'), within the Territory of Basoko, DRC, lies on the southern boundary of the northern-most extent of the Congo River and still has forested areas, some of them within Unilever's Lokutu Oil Palm Plantation concession (N 01° 08' 43.2" E 23° 36' 53.7"). The climate at Lokutu is probably very similar to that for Kisangani, 250 km up the Congo River to the east. At Kisangani, the mean annual temperature is approximately 25° C. Climate type is equatorial (Stock 2004) with no monthly mean temperature below18°C. Mean monthly rainfall is between 100 mm and 199 mm (Stock 2004). Total annual rainfall varies between 1400 mm and 2200 mm (Goudie 1996). Thus, there is little seasonality in the climate of the region, although rainfall tends to be highest during April and October (Anon. 2005). The soils of the area are pedalfers (ferrasols) (Areola 1996), acidic soils in which iron and aluminum oxides have accumulated.

Lokutu Plantation Concession (630 km²) was granted in 1911 and the first oil palms (*Elaeis guineensis*) were planted in 1922. Today, this is an active plantation of which ca. 100 km² are covered with oil palm (and some cocoa and coffee). The remaining ca. 530 km² are lightly to heavily degraded (i.e., covered with secondary forest, scrub, fallow fields, or garden crops grown by plantation workers and settlers — especially cassava and bananas). At one time, the Lokutu area was completely covered with lowland moist forest (Grainger 1996). The plantation has been cleared except for narrow strips of forest along streams and rivers, and two (ca. 50 km² each) forest blocks in the northwest of the concession. These two blocks, as well as the forests surrounding the Plantation, have been selectively logged.

Lokutu Plantation employs ca. 1,900 people. The total population of the Lokutu area is ca. 10,000 people. During this survey, the streams and rivers within the interior of these forests were flowing normally for this time of year.

Lokutu is located in the northeastern section of the region south of the Great Bend of the Congo River, sometimes referred to as the *Cuvette Centrale*. Lokutu is adjacent to the Maringa-Wamba-Lopori landscape, targeted for conservation and development activities under the Congo Basin Forest Partnership (CBFP). Despite the high conservation importance of this landscape, there are no protected areas in this region. Lokutu forms a significant demographic and economic center in this otherwise sparsely populated area.

A first short survey of the area around the village of Lokutu in September 2002 examined the opportunity of an involvement of CI in the logging and oil palm concession of Unilever. A CI team reported the area to be of little or negligible conservation value. We investigated this statement with a much stronger biological emphasis. On the basis of a two-week survey, we herein present a preliminary inventory of the flora and fauna of the Lokutu region.

RAP STUDY SITES

We conducted surveys during the dry season over 14 days (25 October – 8 November 2004) in forests within and near Unilever's Lokutu Plantation Concession. Surveys focused mainly on four forest sites (see Map, Table 1.1). Lobolo (Site 2) is located ca. 31 km to the northwest of Lokutu Village, and Lukumete (Site 4) is located about ca. 26 km to the northwest of Lokutu Village. A short flight over the area confirmed that a large part of the forest around Lokutu Village had been either destroyed or heavily altered for oil palm plantations and other agricultural uses.

The original RAP plan was to survey sites far to the south of Lokutu, beyond where significant levels of logging or hunting would have occurred. The data from such sites would have provided a useful baseline and insights into what species of plants and animals might have been present at Lokutu prior to the establishment of the oil palm plantation and the related large influx of people. However, due to permit restrictions and the inflexibility of the local authorities, we had access to only a few selected areas of slightly to highly degraded natural forests within and close to the Lokutu Plantation. This was a severe impediment to our evaluation of the Lokutu area as a site for conservation investment and action. Nevertheless, while we were unable to compare low impact sites with the high impact sites we surveyed, our conclusions regarding the current value of the Lokutu Oil Palm Plantation as a site for conservation are firmly grounded.

Table 1.1. Principal survey sites in the Lokutu area, Democratic Republic of Congo.

Site name	Coordinates	Description
Lokutu Village & Airstrip (Site 1)	N 01° 08' 43.2" E 23° 36' 53.7" 395 m a.s.l.	Located on the south (left) bank of the Congo River. An intensively cultivated area and village of ca. 10,000 people that was established in 1911. Headquarters of the Unilever Oil Palm Plantation. Oil palm processing factory, loading dock, and airstrip located here. Much oil palm grown here, and some bananas, cassava, sugar cane, mangoes, beans, yams and other crops. Highly altered vegetation with only small, degraded remnants of natural forest remaining. Dates present: October 26–31; November 6–9.
Lobolo (Site 2)	N 00° 54' 53.1" E 23° 27' 16.4" 410 m a.s.l.	2 km SW of Lothi. Degraded forest next to oil palm plantation. Main road passes here. High human population nearby. October 29–30.
Lothi (Site 3)	N 00° 55' 41.7" E 23° 32' 27.5" 390 m a.s.l.	Degraded forest next to oil palm plantation and the small (1 m wide) Lingomo stream. October 30.
Lukumete (Site 4)	N 01° 17' 38.7" E 23° 25' 53.3" 380 m a.s.l.	The largest and least degraded forest surveyed, and also the forest farthest from Lokutu Village. Several small to medium-sized streams (Dumba, Moha, Lukumete, Letissé, and Lingunguare) are located within this site, as is the 12-18 m wide Lunua River. The Lunua River was a 4.7 km walk to the west of camp and represented the most remote area surveyed (N 01° 17' 45.3"; E 23° 25' 53.3"; 360 m a.s.l.). Parts of this site are dominated by Mbau (also known as 'Limbali') *Gilbertiodendron dewevrei*. African celtis (*Celtis mildebraedii*) was also common here. This was the most intensively sampled of the four sites. November 1–6.

THREATS TO BIODIVERSITY

Africa's tropical rainforests and wildlife have been severely degraded in recent decades by many threats, including industrial logging, slash-and-burn agriculture, over-hunting, disease and increasing infrastructure development. In DRC, vast timber leases have been granted to Zimbabwean, German, Malaysian, and Chinese corporations. Logging has important impacts on tropical ecosystems and wildlife (Malcolm and Ray 2000; Laurance et al. 2006), but often its most pervasive effects are secondary: by creating extensive networks of roads and bulldozer tracks, logging greatly increases physical access to forests for hunters, miners, and farmers that can severely degrade or destroy forests (Wilkie et al. 1992; Laurance 2001).

As the human population has increased, traditional forms of forest exploitation, like the gathering of fuelwood and building poles, have grown sharply. Hunting pressure is growing rapidly throughout Central Africa, as road networks expand and the area of forest accessible to hunters increases (Wilkie et al. 1992; Barnes et al. 1997; Fa et al. 2005). Moreover, the efficiency of hunters has increased because shotguns and cable snares have replaced traditional crossbows, spears, nets, snares made from bush rope (Noss 1998; Lahm 2001). Few remaining areas of forest are inaccessible to hunters (Wilkie et al. 2000). Populations of hunted wildlife, especially larger-bodied species like duikers, buffalo, elephants, monkeys and apes, have declined sharply within 10–15 km of villages and roads (Barnes et al. 1991; Lahm et al. 1998, Fa et al. 2000; Lahm 2001). In addition, commercial hunters use hunting and logging camps to penetrate deep into remaining forest tracts (Wilkie et al. 1992; 2000; Lahm 2001).

Wild meat is a key protein source in rural areas and is favored in towns and cities. Improved road networks drive a burgeoning commercial bushmeat trade (Milner-Gulland et al. 2003). Hunting typically contributes between 30 to 80% of protein consumed by forest-dwelling families in the Congo Basin (Koppert et al. 1996), representing almost all animal-based protein consumed. It is estimated that more than 1 million tons of antelope, pigs, rodents and other wildlife are killed and eaten every year in Central Africa (Wilkie and Carpenter 1999). Of 57 mammal, bird, and reptile species hunted in the Congo Basin, 60% are exploited unsustainably (Fa et al. 2002).

In DRC, the human population is expected to double (from 50–60 million to 100–120 million) by 2020 (CBFP 2005). Human population pressure is the root cause of many of the threats mentioned above, driving demand for natural resource consumption in DRC. Immigration to DRC from West Africa is also likely to increase, exacerbating demands on the natural resource base.

Armed conflicts in countries neighboring DRC (Rwanda, Burundi, Uganda, Congo, Sudan, Central African Republic,

and Angola) have killed millions of people with associated impacts on forests, wildlife, and national-park staff and infrastructure. In eastern DRC, fighting has pushed refugees west and has also displaced rural populations away from major roads and into the forest and protected areas where they are less likely to encounter soldiers and armed bands. Such conflict-triggered displacement has significant ecological and social impacts (CBFP 2005). Moreover, corruption is a serious impediment to conservation. In a recent report commissioned by the European Community, a complete moratorium on logging in five African nations — including DRC — was recommended in response to issues of corruption (Laurance 2000; Sizer and Plouvier 2000).

OPPORTUNITIES FOR CONSERVATION

Recent developments in the Congo Basin Forest are working to address the situation and propel conservation forward. In March 1999, six heads of state from Central African nations signed the 'Yaoundé Declaration.' This Declaration contains commitments to forest conservation and sustainable forest management, including conserving, in protected areas, a minimum of 10% of each nations' forests (Kamdem-Toham et al. 2003). Since 1999, there has been a 36% increase (40,607 km^2) in the coverage of protected areas across the region's forests. In Gabon, 13 new national parks covering 30,000 km^2 (10% of the country) have been gazetted, and similar processes are underway in Cameroon, Congo, Equatorial Guinea and DRC.

The Congo Basin Forest Partnership (CBFP) conservation activities focus on 11 landscapes that were selected by more than 160 regional and international experts at a workshop in Libreville in April 2000. Landscapes were selected because of their outstanding biodiversity (including their concentration of endemic species), because they encompass intact populations of larger mammals (e.g., elephant, buffalo, robust chimpanzee and gorilla in forest wilderness), or because they represent important and distinctive habitats and communities of species. Priority landscapes represent zones within which conservation should play a prominent role, through various activities in protected areas and corridors, and through sustainable forestry management and community-based natural resource management. Within these landscapes, the CBFP is working with a range of government and nongovernmental organizations to conserve biodiversity and promote sustainable land use practices.

REFERENCES

Achard, F., H.D. Eva, H.J. Stibig, P. Mayaux, J. Gallego, T. Richards and J.P. Malingreau. 2002. Determination of deforestation rates of the world's humid tropical forests. Science 297: 999–1002.

Anonymous. 2005. Climate Controls. Climographs / Africa. Web site: http://people.cas.sc.edu/carbone/modules/mods4car/ccontrol/questions/africa.html

Areaola, O. 1996. Soils. *In*: Adams, W.M., A.S. Goudie and A.R. Orme (eds.). The Physical Geography of Africa, pp. 134–147. Oxford University Press, Oxford, UK.

Barnes, R.F., W.K. Barnes, M. Alers and A. Blom. 1991. Man determines the distribution of elephants in the rain forests of northeastern Gabon. African Journal of Ecology 29: 54–63.

Barnes, R.F.W., K. Beardsley, F. Michelmore, K.L. Barnes, M. Alers and A. Blom. 1997. Estimating forest elephant numbers with dung counts and a geographic information system. Journal of Wildlife Management 61: 1384–1393.

[CBFP] Congo Basin Forest Partnership. 2005. The Forests of the Congo Basin: a Preliminary Assessment. Available online, 15 Oct 2006. http://carpe.umd.edu/products/PDF_Files/FOCB_APrelimAssess.pdf

Colyn, M., A. Gautier-Hion and W. Verheyen. 1991. A re-appraisal of palaeoenvironmental history in Central Africa: evidence for a major fluvial refuge in the Zaire Basin. Journal of Biogeography 18: 403–407.

Fa, J.E., J.E.G. Yuste and R. Castelo. 2000. Bushmeat markets on Bioko Island as a measure of hunting pressure. Conservation Biology 14: 1602–1613.

Fa, J.E., C.A. Peres and J. Meeuwig. 2002. Bushmeat exploitation in tropical forests: an intercontinental comparison. Conservation Biology 16: 232–237.

Fa, J.E., S.F. Ryan and D.J. Bell. 2005. Hunting vulnerability, ecological characteristics and harvest rates of bushmeat species in afrotropical forests. Biological Conservation 121: 167–176.

Goudie, A.S. 1996. Climate: past and present. *In*: Adams, W.M., A.S. Goudie and A.R. Orme (eds.). The Physical Geography of Africa, pp. 34–59. Oxford University Press. Oxford, UK.

Kamdem-Toham, A., A.W. Adeleke, N.D. Burgess, R. Carroll, J. D'Amico, E. Dinerstein, D.M. Olson and L. Some. 2003. Forest conservation in the Congo Basin. Science 299: 346.

Koppert, G.J.A., E. Dounias, A. Froment and P. Pasquet. 1996. Consommation alimentaire dans trois populations forestières de la region côtière du Cameroun: Yassa, Mvae et Bakola. *In:* Hladik, C.M., A. Hladik and H. Pagezy (eds.). L'alimentation en forêt tropicale. Interactions bioculturelles et perspectives de développement, pp 477–496. Orstom, Paris.

Lahm, S.A. 2001. Hunting and wildlife in northeastern Gabon: why conservation should extend beyond park boundaries. *In:* Weber, W., L.J.T. White, A. Vedder, and N. Naughton-Treves (eds.). African Rain Forest Ecology and Conservation, pp. 344–354. Yale University Press, New Haven, CT.

Lahm, S.A., R.F.W. Barnes, K. Beardsley and P. Cervinka. 1998. A method for censusing the greater white-nosed

monkey in northeastern Gabon using the population density gradient in relation to roads. Journal of Tropical Ecology 14: 629–643.

Laurance, W.F. 1999. Reflections on the tropical deforestation crisis. Biological Conservation 91: 109–117.

Laurance, W.F. 2000. Cut and run: the dramatic rise of transnational logging in the tropics. Trends in Ecology and Evolution 15: 433–434.

Laurance, W.F. 2001. Tropical logging and human invasions. Conservation Biology 15: 4–5.

Laurance, W.F., A. Alonso, M. Lee and P. Campbell. 2006. Challenges for forest conservation in Gabon, Central Africa. Futures 38: 454–470.

Malcolm, J. and J.C. Ray. 2000. Influence of timber extraction routes on central African small-mammal communities, forest structure, and tree diversity. Conservation Biology 14: 1623–1638.

Maley, J. 1996. The African rain forest – Main characteristics of changes in vegetation and climate from the Upper Cretaceous to the Quaternary. The Royal Society of Edinburgh Proceedings Section B (Biological Sciences) 104: 31–74.

Milner-Gulland, E.J., E.L. Bennett and the SCB 2002. Annual Meeting Wild Meat Group. 2003. Wild meat: the bigger picture. Trends in Ecology and Evolution 18: 351–357.

Mittermeier, R.A., P.R. Gil, M. Hoffmann, J. Pilgrim, T. Brooks, C.G. Mittermeier, J. Lamoreux, G.A.B. da Fonseca. 2004. Hotspots Revisited. Cemex, Mexico City.

Mittermeier, R.A., C.G. Mittermeier, T.M. Brooks, J.D. Pilgrim, W.R. Konstant, G.A.B. da Fonseca and C. Kormos. 2003. Wilderness and biodiversity conservation. Proceedings of the National Academy of Sciences of the United States of America 100: 10309–10313.

Naughton-Treves, L. and W. Weber. 2001. Human dimensions of the African rain forest. *In:* Weber, W., L.J.T. White, A. Vedder, and N. Naughton-Treves (eds.). African Rain Forest Ecology and Conservation, pp. 20–46. Yale University Press, New Haven, CT.

Noss, A.J. 1998. The impacts of cable snare hunting on wildlife populations in the forests of the Central African Republic. Conservation Biology 12: 390–398.

Olson, D.M. and E. Dinerstein. 1998. The Global 200: a representation approach to conserving the earth's most biologically valuable ecoregions. Conservation Biology. 12: 502–515.

Sizer, N. and D. Plouvier. 2000. Increased Investment and Trade by Transnational Logging Companies in Africa, the Caribbean and the Pacific. Joint report of the World Wide Fund for Nature-Belgium, World Resources Institute, and WWF-International.

Stock, R. 2004. Africa South of the Sahara: a Geographical Interpretation. 2nd Edition. The Guilford Press. New York, USA.

Terborgh, J. 1992. Diversity and the Tropical Rain Forest. W.H. Freeman and Company, New York.

Vedder, A., L. Naughton-Treves, A. Plumptre, L. Mubalama, E. Rutagarama and W. Weber. 2001. Conflict and conservation in the African rain forest. *In:* Weber, W., L.J.T. White, A. Vedder, and N. Naughton-Treves (eds.). African Rain Forest Ecology and Conservation, pp. 557–562. Yale University Press, New Haven, CT.

White, L. 2001. The African rain forest: climate and vegetation. *In:* Weber, W., L.J.T. White, A. Vedder, and N. Naughton-Treves (eds.). African Rain Forest Ecology and Conservation, pp. 2–29. Yale University Press, New Haven, CT.

Wilkie, D.S. and J.F. Carpenter. 1999. Bushmeat hunting in the Congo Basin: an assessment of impacts and options for mitigation. Biodiversity and Conservation 8: 927–955.

Wilkie, D.S. and N. Laporte. 2001. Forest area and deforestation in central Africa: current knowledge and future directions. *In:* Weber, W., L.J.T. White, A. Vedder, and N. Naughton-Treves (eds.). African Rain Forest Ecology and Conservation, pp. 119–139. Yale University Press, New Haven, CT.

Wilkie, D.S., J.G. Sidle and G.C. Boundzanga. 1992. Mechanized logging, market hunting, and a bank loan in Congo. Conservation Biology 6: 570–580.

Wilkie, D.S., E. Shaw, F. Rothberg, G. Morelli and P. Auzel. 2000. Roads, development, and conservation in the Congo Basin. Conservation Biology 14: 1614–1622.

Chapter 2

A Brief Botanical Survey at Lokutu

W. R. Quentin Luke

SUMMARY

During this RAP survey, 485 taxa of indigenous plants were recorded, and some 89 more taxa of exotics or crop plants noted. The low botanical diversity of the palm plantations is compared with some near-primary forest. The most interesting of the timber species was *Pericopsis elata* or Afrormosia. Considering that the Kisangani area was quoted as the last stronghold of this species, the very low stocking rate noted during this survey suggests that the situation is more serious than previously thought.

METHODS

(See Introduction and Map for information on study sites.)

It was understood that no quantitative ecological survey was required during the assessment. As such, it was planned to keep a sequential list of plant species, recording taxa by name as "sight records" (sr) if positively identified, or making proper botanical collections if there was doubt in identification. Sight records were also employed where plants were not fertile and attempts to identify sterile collected specimens were judged to be futile. In most of these cases, identification was possible to family and, in many cases, to genus. A separate list of exotic/crop species was compiled (Appendix 2) which included plants thought to be introduced or species generally considered 'weed' species.

Specimen collections were intended to be in quadruplicate, the intention being to distribute specimens to the following Herbaria: EA (East African, Nairobi), K (Kew, London), MO (Missouri, USA) and a suitable institution within DRC if it could be ascertained that proper preservation and use would be made of the sheet. Due to the fact that sufficient newspaper did not arrive in Lokutu, the specimen collections were reduced to duplicate only to make best use of the limited amount of newspaper. This not only reduced the value of the collections made, but also subconsciously reduced the overall number of collections due to the worry of running out of paper. It should be noted that the supply did finish on the last day with the result that some unpressed specimens were hand carried to Kinshasa for pressing at the Bonobo Sanctuary.

Collected material, after pressing, was dried on Quentin Luke's (QL) drier. Since the availability of charcoal in the field was uncertain and a normal East African type charcoal 'jiko' was not available in the Kinshasa market, a paraffin stove was purchased — which entailed its own set of problems (difficulty in finding kerosene and over-heating).

Initially all botanical work was carried out by QL alone.

RESULTS AND DISCUSSION

Attempts to enter primary forest to the south were thwarted by local officials not accepting documentation carried by the team. The expulsion of the group in the middle of the night not only prevented survey of the south but also wasted much valuable survey time.

The expedition to the west resulted in some exposure to secondary forest, apparently logged either 10 or 50 years previously (trustworthy information was not available). The site's proximity to the Congo River with several streams throughout suggested that it was probably inundated for some of the year. Species composition agreed with those cited for Swamp Forest (Mousamboté 1994), with patches of monodominant *Gilbertiodendron*. Trees to 45 m were observed (including several Cat 1 timber species, J. Penner, pers. obs.), although the average canopy height was more in the region of 15–20 m. The forest held species cited (Mosango 1991) as being constituents of primary forest (*Piptadeniastrum africanum* and *Celtis mildbraedii*), and also those considered as old secondary forest *(Zanthoxylum gilletii* and *Petersianthus macrocarpus*) so perhaps the past disturbance was not very great and restricted to those areas where *Musanga cecropioides* was dominant.

The most interesting of the timber species was *Pericopsis elata,* or Afrormosia as it is known in the trade. During a recent review of CITES criteria for listing species on the appendices, QL was given this species to test the criteria. One of the factors noted was the extremely low stocking rate (Hawthorne 1995) of two individuals per ha in Ghana. During the survey, six individuals were noted during the walk to the Lunoir River, a distance of 4.7 km which corresponds to a stocking rate of six trees in 18.8 ha (if a 40 m wide strip is taken as the "transect"), or 0.32 individuals per ha. Considering that the Kisangani area is described as the last stronghold of this species, the situation is more serious than previously thought.

The islands in the Congo River near Lokutu were visited and sampled briefly, as was the main riverbank downriver from Lokutu, and both proved to be very interesting botanically. Possibly more time should have been spent on dug-out canoe sampling along the river.

The sum total of plant taxa recorded, excluding those listed in Appendix 2 as crop/exotic/weed/naturalised species (89), is 485 taxa. These are listed in Appendix 1 in alphabetical order (both families and genera) but separated into Pteridophytes, Dicotyledons and Monocotyledons. Rubiaceae was by far the most common family encountered, many of which were in fruit only and will be extremely difficult to identify to species. The breakdown of the most common families and the different life forms encountered is as follows:

Largest Families

Taxa	
Rubiaceae	49
Pteridophytes	32
Euphorbiaceae	30
Moraceae	21
Papilionaceae (Leguminosae)	20

Breakdown of Life Forms	
Trees	157
Shrubs	78
Climbers (incl. scandent shrubs)	93
Herbs	103
Epiphytes (excl.Ferns)	10
Epiphytic Ferns	14
Ferns (terrestrial)	18

At the time of writing, 10 collections have not yet been assigned to a family.

While most of the collections have yet to be identified, it is felt that there is a low probability that any particularly rare or new plant species were collected. This has two explanations, the first is that the vegetation of the basin is very uniform over very large areas, the second is that the team did not get very far away from the Congo River, and thus most of the area visited had probably been investigated thoroughly by past researchers.

REFERENCES

Hawthorne, W.D. 1995. Ecological Profiles of Ghanaian Forest Trees. Oxford Forestry Institute.

Mosango, M. 1991. Contribution à l'Étude Botanique et Biogéochemique de l'Écosystème Forêt en Région Équatoriale (Île Kongolo, Zaïre). Belg. Journ. Bot. 124(2): 167–194.

Mousamboté, J.M., T. Yumoto, M. Mitani, T. Nishihara, S. Suzuki, and S. Kuroda. 1994. Vegetation and List of Plant Species Identified in the Nouabalé-Ndoki Forest, Congo. Tropics 3 (3/4):277–293.

Chapter 3

Dragonflies and Damselflies (Odonata) of Lokutu

Klaas-Douwe B. Dijkstra

SUMMARY

Odonata were surveyed during a Rapid Assessment Program (RAP) survey of the Lokutu area in central Democratic Republic of Congo. Eighty-six mostly Guineo-Congolian running-water species were found, with remarkable range extensions, as well as new species of *Platycypha*, *Elattoneura* and *Mesocnemis*. The results indicate a healthy watershed in the Lokutu surroundings, with limited degrees of pollution and streambed erosion. If forest cover and natural stream morphology are retained, the rich dragonfly fauna will be as well. The obtained species list is especially long considering the paucity of stagnant water species and the absence of certain Congolian endemics. This is explained by the absence of their habitat and possibly by the barrier that the extensive forest surrounding Lokutu (still) poses to the dispersal of open land species. The observed richness is probably typical of the Congo Basin as a whole and other areas are expected to be even richer. Therefore the Lokutu area does not require specific conservation action.

Unlike other groups traditionally surveyed in RAPs, Odonata are invertebrates, strongly tied to freshwater, that are not actively exploited by humans. This RAP proved that it is possible to rapidly obtain a clear picture of Odonate diversity, even allowing a partial description of their ecology. The rich and apparently largely natural Odonate fauna found contrasts with the impoverished and imperiled status of the other groups studied. Therefore it is recommended to use Odonata more frequently to supplement biodiversity assessments of traditional groups, especially in the Congo Basin, where sampling Odonata may show whether existing conservation priorities also protect watersheds and freshwater biodiversity.

INTRODUCTION

Odonata (dragonflies and damselflies) are receiving increasing interest from scientists and the public. These graceful, colorful creatures are the quintessence of freshwater health. Due to their attractive appearance, dragonflies and damselflies can function as guardians of the watershed. They can be flagships for conservation not only of water-rich habitats, such as wetlands and rainforests, but also for habitats where water is scarce and, therefore, especially vital to the survival of life. Their sensitivity to structural habitat quality (e.g., forest cover, water clarity) and amphibious habits make Odonata well suited to be used in evaluating environmental change in the long term (biogeography, climatology) and in the short term (conservation biology), both above and below the water surface (Corbet 1999).

Odonata larvae are critical indicators of the morphology and water quality of their aquatic habitats (e.g., bottom substrate, vegetation structure) while adult Odonata exhibit strong selection with regards to the structure of their terrestrial habitats (e.g., degree of shading). As a consequence, Odonata show strong responses to habitat changes such as deforestation and erosion. Ubiquitous species prevail in disturbed or temporary waters, while habitats like pristine streams and swamp forests harbor a wealth of more vulnerable and often localized species.

Different ecological requirements are linked to different dispersal capacities. Species with narrow niches disperse poorly, while pioneers of temporal habitats (often created by disturbance) are excellent colonizers. For this reason, Odonata have a potential use in the evaluation of habitat connectivity (Clausnitzer 2003, Dijkstra and Lempert 2003).

Odonata possess characteristics distinct from those of relatively well-studied groups like plants, butterflies, birds and mammals. Therefore, their study will supplement knowledge obtained from these better-known groups. There are also practical advantages to Odonata as environmental monitors. Aquatic habitats, the focal point of their life histories, are easy to locate, and their diurnal activity and high densities make them easy to study. Extensive experience with monitoring Odonata has been obtained in Europe and elsewhere. The number of dragonfly species occurring in Africa is manageable, their taxonomy is fairly well resolved, and identification is relatively straightforward. Considering the ever-changing nature of the African landscape, be it under human, geological or climatic influence, the study of African Odonata constitutes an exciting challenge, as knowledge of their geography, ecology and phylogeny may help to understand the past and future of a rapidly changing continent.

Called an "evolutionary whirlpool" by Kingdon (1989), the Congo Basin is one of the most interesting parts of Africa for Odonata. From west to east it connects the continent's main rainforests with its main highlands, to the north and south it gently grades through a mosaic of forest, woodland and savannah towards the dry lands of the Sahara and Kalahari. With its forests, rivers and swamps, the Basin itself is an endless succession of prime Odonate habitat. Africa's wet heart is the center of diversity of several genera, especially in Libellulidae, including poorly known genera such as *Aethiothemis*, *Lokia*, *Porpax,* and the aptly named *Congothemis*. Probably the radiation and preservation of Odonate species during Africa's climatic vicissitudes were centered on the Basin.

We largely owe our knowledge of the Congolese fauna to the efforts of Belgian collectors who assembled their material in the 1930s to 1960s. Almost no research took place during the last three decades of the 20th century, while earlier efforts were concentrated in a handful of peripheral regions (Fig. 3.1). The knowledge of most of the lower Basin ('cuvette') is, therefore, marginal.

METHODS

(See Introduction and Map for information on study sites.)

Adult and larval Odonata were observed and caught with a hand net during daylight at freshwater habitats (Table 3.1), and details of their ecology and behavior were noted. Identifications were made using Clausnitzer and Dijkstra (in prep.); nomenclature follows Dijkstra and Clausnitzer (in prep.). Relevant name-changes from that unpublished checklist are provided in the footnotes of Table 3.2.

Collected specimens are deposited in the National Museum of Natural History (RMNH, Leiden, The Netherlands); comparisons with Congolese (type) material were made in the Royal Museum for Central Africa (MRAC, Tervuren, Belgium).

Table 3.1. Principal Odonata study sites in the Lokutu area, DRC. Accuracy of coordinates varies with size of site and precision with which a GPS reading could be taken. All sites lie at approximately 400 m a.s.l.

		Coordinates	Description
Co	Congo near Lokutu	1°10'N 23°37'E	Huge river (> 1 km broad) with mostly forested banks, others sandy or dominated by *Eichhornia*
Du	Dumba	1°17.65'N 23°24.10'E	Large shallow, sandy, clear blackwater stream (4–8 m) with much *Pandanus* and some grassy verges in forest
Lc	Lukumete camp	1°17.6'N 23°25.8'E	Two small streams in forest, partially sandy, muddy, and with much leaf litter
Le	Letissé	1°16.34'N 23°27.23'E	Large shallow, sandy, clear stream (3–5 m) with in disturbed forest
Lg	Lingungu	1°17.6'N 23°25.9'E	Large shallow, sandy, clear stream (2–4 m) within forest
Lk	Lukumete plantation	1°16'N 23°28'E	Swampy streams (1–2 m) in gallery forest opening up into edge of oil palm plantation
Lm	Lingomo	0°55.30'N 23°27.88'E	Small, gravel-bottomed stream (1 m) in gully in forest
Lo	Lokutu plantation	1°08.8'N 23°36.9'E	Oil palm plantation with stagnant waters, such as grassy pools, swampy fishponds, and a disused swimming pool
Lt	Loti	0°55.81'N 23°32.45'E	Larger turbid river (8–12 m) in gallery forest beside oil palm plantation
Lu	Lunua	1°17.73'N 23°23.35'E	Large turbid river (12–18 m) in forest with adjacent flooded areas

RESULTS

Table 3.2 summarizes the records of the species found, and characterizes their ranges and ecology.

DISCUSSION

Because no prior research of Odonata has been undertaken in the Lokutu region, any result from the area greatly supplements the knowledge of the Congolese fauna. However, interpretation of the results is difficult, as there are limited references for comparison. The nearest sites with reasonable inventories are Bambesa, 350 km to the northeast, and the Kungu and Mbandaka areas 550–600 km to the west (Fig. 3.1). Not only are these sites distant, they also differ biogeographically and ecologically, lying on the northwestern edge of the Ituri Forest and the swamp forest heart of the 'Cuvette Centrale' respectively.

The total of 86 species found is high, especially considering that only 24 (28%) of species found are widespread Afrotropical species: the remaining 62 (72%) are Guineo-

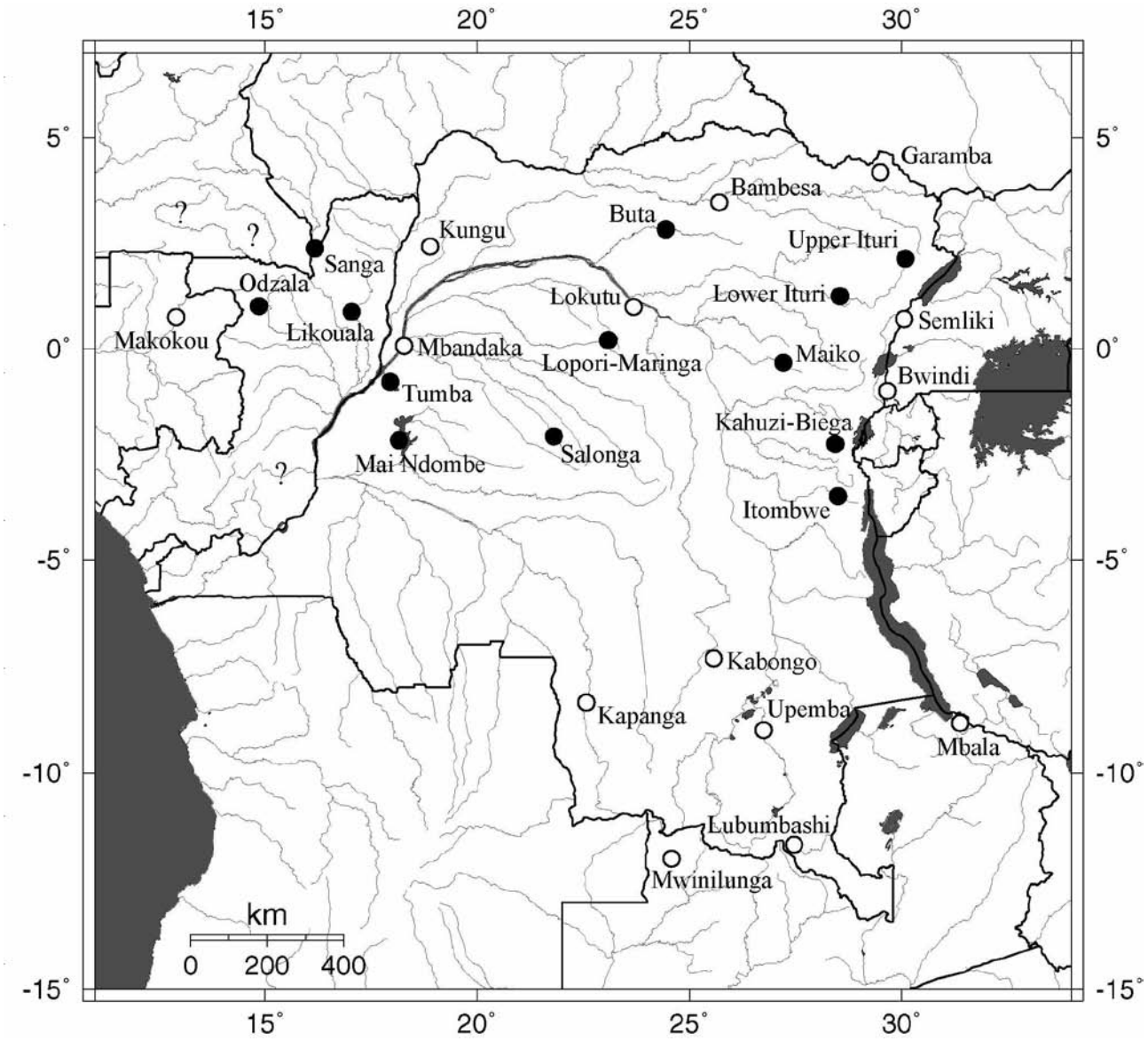


Figure 3.1. Position of Lokutu relative to sites with reasonable historic data (open circles) and selected sites within areas of highest and high conservation priority (filled circles), none of which have been surveyed for Odonata. Possible additional sites of conservation importance are indicated by question marks. Priorities follow the assessment of the Congo Basin Forest Partnership. Lokutu and other open circle sites do not lie within CBFP areas of conservation priority.

Table 3.2. Species of Odonata recorded from the Lokutu area, DRC. See Table 3.1 for site details and names. Preferences are inferred from observations during fieldwork, augmented with previous experience. Clear preferences are indicated with capital letters. Less clear preferences are bracketed, either because data were insufficient, a species is catholic in its choice, or the habitat is of secondary importance to the species.
S: status (1: single record, S: several observations, M: many observations)
B: biogeography of the species (A: all over tropical Africa including savannahs, B: confined to Congo Basin, C: confined to Central Africa (eastern Nigeria to western Kenya), E: ranging largely in forest of Eastern Africa (eastern DRC to western Kenya), W: West and Central Africa
R: breeds in running water (S: small streams, M: large streams and small rivers, L: large rivers)
St: breeds in standing water (pools, swamps)
F: favors forested habitats and avoids open areas
O: favors open habitats avoiding forest (farmland, bush, savannah).

							Sites									
	S	B	R	St	F	O	Lo	Lm	Lc	Lk	Lg	Le	Du	Lt	Lu	Co
ZYGOPTERA																
Calopterygidae																
***Phaon* Selys, 1853**																
Phaon camerunensis Sjöstedt, 1900	M	W	L		F										+	
***Umma* Kirby, 1890**																
Umma cincta (Hagen in Selys, 1853)	1	W	M		F											
Umma longistigma (Selys, 1869)	M	C	M		F						+	+	+			
Umma saphirina Förster, 1916	M	C	S		F			+	+			(+)				
Chlorocyphidae																
***Chlorocypha* Fraser, 1928**																
Chlorocypha aphrodite (Le Roi, 1915)	M	B	M		F					+	+	+	+			
Chlorocypha pyriformosa Fraser, 1947	M	W	L		F									+	+	+
Chlorocypha cf. *trifaria* (Karsch, 1899)	M	E	S		F			+			+	+				
***Platycypha* Fraser, 1949**																
Platycypha sp. nov.	M	B	M		(f)						+	+				
Protoneuridae s.s.																
***Elattoneura* Cowley, 1935**																
Elattoneura centrafricana Lindley, 1976	S	B	S		F				+	+						
Elattoneura sp. nov. cf. *lliba* Legrand, 1985	M	B	SM		F			+	+		+	+	+			
***Prodasineura* Cowley, 1934**																
Prodasineura vittata (Selys, 1886)	S	C	S		F			+								
Platycnemididae s.l.																
***Chlorocnemis* Selys, 1863**																
Chlorocnemis cyanura Förster, 1909 [1]	S	C	S		F				+							

continued

Table 3.2. *continued*

							Sites									
	S	**B**	**R**	**St**	**F**	**O**	**Lo**	**Lm**	**Lc**	**Lk**	**Lg**	**Le**	**Du**	**Lt**	**Lu**	**Co**
Chlorocnemis nigripes Selys, 1886	S	C	S		F			+								
Chlorocnemis pauli Longfield, 1936	S	E	S		F			+								
***Mesocnemis* Karsch, 1891**																
Mesocnemis singularis Karsch, 1891	1	A	L		(f)	(o)										+
Mesocnemis sp. nov.	S	B	L		(f)	(o)										+
***Platycnemis* Burmeister, 1839**																
Platycnemis nyansana Förster, 1916 [2]	M	E		St	F					+			(+)		(+)	(+)
Coenagrionidae																
***Agriocnemis* Selys, 1877**																
Agriocnemis forcipata Le Roi, 1915	M	C		S	(f)	(o)	+							(+)		
Agriocnemis maclachlani Selys, 1877	S	W		S	(f)					+				(+)		
Agriocnemis stygia Fraser, 1954	1	B		?	F											(+)
***Ceriagrion* Selys, 1876**																
Ceriagrion corallinum Campion, 1914	S	W		S	(f)	(o)	+									
Ceriagrion glabrum (Burmeister, 1839)	M	A		S		O	+									
Ceriagrion ignitum Campion, 1914	M	W		S	(f)	(o)	+									
***Pseudagrion* Selys, 1876 (A-group)**																
Pseudagrion kibalense Longfield, 1959	M	E	S		F			+	+		+	(+)		(+)		
Pseudagrion melanicterum Selys, 1876	M	W	M		(f)	(o)	+					+		+		
Pseudagrion simplicilaminatum Carletti & Terzani, 1997	S	B	M		F								+			
Pseudagrion superbum Fraser, 1956	M	B	M		F						+		+			
***Pseudagrion* Selys, 1876 (B-group)**																
Pseudagrion glaucum (Sjöstedt, 1900) [3]	M	W	L	S	(f)		+									+
Pseudagrion nubicum Selys, 1876	M	A	L			O										+
Pseudagrion sjoestedti Förster, 1906	1	A	L		(f)	(o)										+
ANISOPTERA																
Aeshnidae																
***Heliaeschna* Selys, 1882**																
Heliaeschna fuliginosa Selys, 1883	1	W	S		F				+							

continued

Table 3.2. *continued*

							Sites									
	S	B	R	St	F	O	Lo	Lm	Lc	Lk	Lg	Le	Du	Lt	Lu	Co
Gomphidae																
***Diastatomma* Burmeister, 1839**																
Diastatomma selysi Schouteden, 1934	S	E	SM		F				+		+					
***Gomphidia* Selys, 1854**																
Gomphidia bredoi (Schouteden, 1934)	S	W	L		(f)	(o)										+
***Ictinogomphus* Cowley, 1934**																
Ictinogomphus regisalberti (Schouteden, 1934)	M	B	L		F									+	+	+
***Lestinogomphus* Martin, 1911**																
Lestinogomphus sp.	1	?	L		F?											+
***Neurogomphus* Karsch, 1890**																
Neurogomphus cf. *chapini* (Klots, 1944)	S	B	L		F?											+
Neurogomphus cf. *uelensis* Schouteden, 1934	1	C	L		F?											+
***Paragomphus* Cowley, 1934**																
Paragomphus acuminatus Fraser, 1949	M	B	L		F											+
Paragomphus nigroviridis Cammaerts, 1969	S	W	M		F						+					
***Phyllogomphus* Selys, 1854**																
Phyllogomphus annulus Klots, 1944	1	B	M		F									+		
Phyllogomphus coloratus Kimmins, 1931	S	C	ML		F						+					+
Libellulidae																
***Acisoma* Rambur, 1842**																
Acisoma trifidum Kirby, 1889	M	W		S	(f)		+									
***Aethriamanta* Kirby, 1889**																
Aethriamanta rezia Kirby, 1889	1	A		S	(f)	(o)	+									
***Brachythemis* Brauer, 1868**																
Brachythemis lacustris (Kirby, 1889)	M	A	L		(f)	(o)										+
Brachythemis leucosticta (Burmeister, 1839)	M	A	L	S		O										+
***Chalcostephia* Kirby, 1889**																
Chalcostephia flavifrons Kirby, 1889	M	A		S?	(f)	(o)	+			+				(+)		
***Congothemis* Fraser, 1953**																
Congothemis apicalis (Fraser, 1954) [4]	1	C	?	?	F			(+)								
***Cyanothemis* Ris, 1915**																
Cyanothemis simpsoni Ris, 1915	M	W	ML		F								+		+	

continued

Table 3.2. *continued*

							Sites									
	S	B	R	St	F	O	Lo	Lm	Lc	Lk	Lg	Le	Du	Lt	Lu	Co
***Eleuthemis* Ris, 1910**																
Eleuthemis buettikoferi Ris, 1910	M	W	L		F										+	
***Hadrothemis* Karsch, 1891**																
Hadrothemis coacta (Karsch, 1891)	S	W		S	F			(+)								
Hadrothemis defecta (Karsch, 1891)	M	W	?	S	F		+		+	+		+				
Hadrothemis infesta (Karsch, 1891)	S	W		S	F											
Hadrothemis versuta (Karsch, 1891)	M	W	?	S	F		+	+		+						
Hadrothemis vrijdaghi Schouteden, 1934	1	B		S?	F										(+)	
***Micromacromia* Karsch, 1890**																
Micromacromia camerunica Karsch, 1890	M	C	SM		F				+		+					
***Neodythemis* Karsch, 1889**																
Neodythemis klingi (Karsch, 1890) [5]	S	W	SM		F				+		+					
***Nesciothemis* Longfield, 1955**																
Nesciothemis farinosa (Förster, 1898)	M	A	?	?		O	+			+		+				
***Notiothemis* Ris, 1919**																
Notiothemis robertsi Fraser, 1944	S	W	S?	S	F			+	+							
***Olpogastra* Karsch, 1895**																
Olpogastra lugubris Karsch, 1895	M	A	L			O	+							+		+
***Orthetrum* Newman, 1833**																
Orthetrum austeni (Kirby, 1900)	M	W	?	S	(f)	O	+			+						
Orthetrum brachiale (Palisot de Beauvois, 1817)	1	A		S		O										
Orthetrum chrysostigma (Burmeister, 1839)	1	A		S?		O	+									
Orthetrum hintzi Schmidt, 1951	M	A		S		O	+									
Orthetrum julia Kirby, 1900	1	A	S		(f)	(o)		+								
Orthetrum microstigma Ris, 1911	M	W	M		(f)	(o)				+	+	+				
Orthetrum saegeri Pinhey, 1966	1	W	?		F					+						
Orthetrum stemmale (Burmeister, 1839)	M	A		S	(f)	(o)	+		+							
***Oxythemis* Ris, 1910**																
Oxythemis phoenicosceles Ris, 1910	M	W	?	S	(f)		+			+					(+)	
***Palpopleura* Rambur, 1842**																
Palpopleura deceptor (Calvert, 1899)	1	A		S		O	+									
Palpopleura lucia (Drury, 1773)	M	A		S		O	+							(+)		
Palpopleura portia (Drury, 1773)	M	A		S		O	+							(+)		

continued

Table 3.2. *continued*

							Sites									
	S	**B**	**R**	**St**	**F**	**O**	**Lo**	**Lm**	**Lc**	**Lk**	**Lg**	**Le**	**Du**	**Lt**	**Lu**	**Co**
***Pantala* Hagen, 1861**																
Pantala flavescens (Fabricius, 1798)	M	A		S		O	+							(+)		+
***Porpax* Karsch, 1896**																
Porpax asperipes Karsch, 1896	S	C		S?	F				+							
***Rhyothemis* Hagen, 1867**																
Rhyothemis notata (Fabricius, 1787)	1	A		S	(f)	(o)					(+)			(+)		
***Tetrathemis* Brauer, 1868**																
Tetrathemis camerunensis (Sjöstedt, 1900) [6]	M	W	?	S	(f)					+				+		
***Thermochoria* Kirby, 1889**																
Thermochoria equivocata Kirby, 1889	S	W		S?	F									(+)		
***Tholymis* Hagen, 1867**																
Tholymis tillarga (Fabricius, 1798)	S	A	L	S	(f)	(o)	+									+
***Tramea* Hagen, 1861**																
Tramea basilaris (Palisot de Beauvois, 1817)	S	A		S		O										
***Trithemis* Brauer, 1868**																
Trithemis dichroa Karsch, 1893	1	W	M			O?										
Trithemis grouti Pinhey, 1961	1	W	L			O										+
Trithemis nuptialis Karsch, 1894	M	C	SM		(f)	(o)	+			+						
***Urothemis* Brauer, 1868**																
Urothemis assignata (Selys, 1872)	1	A		S		O	+									
Urothemis edwardsii (Selys, 1849)	1	A	L	S		O	+									+
***Zygonoides* Fraser, 1957**																
Zygonoides occidentis (Ris, 1912) [7]	S	C	L		(f)											+
***Zygonyx* Hagen, 1867**																
Zygonyx flavicosta (Sjöstedt, 1900)	1	W	ML		F									+		
Zygonyx regisalberti (Schouteden, 1934)	S	C	M		F						+					

[1] Formerly placed in *Isomecocnemis* Cowley, 1936.
[2] Formerly erroneously known as *P. congolensis* Martin, 1908.
[3] Formerly known by synonym *P. basicornu* Schmidt in Ris, 1936.
[4] Formerly placed in *Anectothemis* Fraser, 1954 and known by synonym *Porpacithemis trithemoides* Fraser, 1958.
[5] Formerly placed in *Allorrhizucha* Karsch, 1890.
[6] Includes probable synonym *T. bifida* Fraser, 1941.
[7] Formerly placed in *Olpogastra* Karsch, 1895 as a subspecies of *O. fuelleborni* Grünberg, 1902.

Congolian species. Of this group 47% of the species occur almost throughout the Guineo-Congolian realm (i.e., well into West Africa), but the other 53% are more localized, restricted to the forested center of the continent. Thirteen of the species (almost one in six) have yet to be found outside the Congo Basin.

The fairly well studied Bwindi Impenetrable National Park and Semliki National Park of Uganda, both on the DRC border (Fig. 3.1), have 65 and 91 species, respectively, of which 45 (69%) and 47 (52%) are non-widespread species (K.-D.B. Dijkstra, pers. obs.). In comparison, the Lokutu area has a richer fauna of localized (generally forest-associated) odonates. If all widespread species found at Semliki occur around Lokutu (a reasonable assumption), the list would already stand at 109 species. With the addition of poorly sampled groups (see below), the local fauna could number over 125 species. The relative poverty of the western Uganda forests may be a periphery effect: fewer Guineo-Congolian species reach that far east.

Many widespread, well-dispersing species of Odonata are absent from our collection. Ubiquitous savannah species, such as those in the genus *Crocothemis* and the red group of *Trithemis* species, were totally absent, even in disturbed habitats. Some forest groups were also poorly represented: the lack of gynacanthine aeshnids (only *Heliaeschna fuliginosa* was collected, ten more species are possible in the central Basin) and macromiids (up to ten species possible) was also notable, although, in the latter case, several species were observed but could not be caught for identification. MRAC has almost no Odonata from Elisabetha (the historic name of Lokutu), but remarkably among these are *Gynacantha africana* (Palisot de Beauvois, 1807), *G. bullata* Karsch, 1891, *G. manderica* Grünberg, 1902 (a dark Congo Basin form of this savannah species) and *G. sextans* McLachlan, 1896. The discrepancy with our collection could be the effect of season or method: these crepuscular insects may fly into lit buildings at night, although none were among the myriads of insects drawn to the Lokutu Guesthouse during our stay (Dijkstra 2005).

Also notable was the paucity of two categories of characteristic Congo Basin species. Firstly, several taxa that are common and widespread in open habitats in Africa (e.g., savannah) are replaced in the Basin by a larger and darker form (these have been variously treated as species, subspecies or mere varieties). Of collected adults, only the dark Congolian form of *Gomphidia bredoi* belonged to this category. However, exuviae were found that must pertain to the unknown larva of *Zygonoides occidentis* (Fig. 3.2) and a historic *G. manderica* record (housed at the MRAC, see above) also pertained to a Congolian variety. Secondly, the only sign of the endemic libellulid diversity mentioned in the introduction were single specimens of *Congothemis apicalis* and *Hadrothemis vrijdaghi*.

The observed poverty of libellulids, aeshnids and Congolian open land forms is probably explained by the selection of habitats encountered in the region. A flight over the basin revealed numerous other habitat types that are likely to hold these species, such as forested and open swamps, seasonally flooded forest, oxbows, and medium-sized rivers (intermediate between the streams and the Congo River sampled during the survey). These all have stagnant or slow-flowing water, as is typically inhabited by the missing taxa. The wealth of encountered species, especially of the more localized ones, lies in Zygoptera and Gomphidae, which principally inhabit flowing water. The most interesting records obtained belong to these two groups, and are discussed below.

Logically, many of the records constitute range extensions: for instance *Chlorocnemis pauli*, *Pseudagrion kibalense* and *P. superbum* had not been previously found so far west and on the southern side of the Congo River. *Ceriagrion ignitum* (Fig. 3.3f) was previously known only from the Ghanaian type series and its rediscovery in an anthropogenic habitat (fishponds and a disused swimming pool) 2700 km to the east comes as a surprise (Dijkstra 2006). *Pseudagrion simplicilaminatum* (Fig. 3.3e) and *Phyllogomphus coloratus* (Fig. 3.3h) were not known east of Congo-Brazzaville (Carletti and Terzani 1997, F. Terzani pers. comm., Dijkstra et al. 2006). *Chlorocypha pyriformosa* was not known east of Nigeria (Dijkstra 2003), but the discovered populations are somewhat aberrant.

Three species appear to be new to science. Finding distinctive species of the conspicuous but small genera *Platycypha* (Fig. 3.3c) and *Mesocnemis* (Figs 3.4–3.5) is remarkable. With the exception of the widespread *P. caligata* and *P. lacustris*, all *Platycypha* species have rather restricted ranges (Fig. 3.6). The new species fills a gap in the genus's distribution in the central Congo Basin. Although the abdominal coloration is highly distinctive (Fig. 3.7), the new species could not be distinguished genetically from the two widespread species, despite the use of a marker that normally suffices well to separate dragonflies at the species level (H. Hadrys pers. comm.).

All *Mesocnemis* species are superficially alike and inhabit rivers. They can be separated by structural details on the male appendages (Fig. 3.4) and anteriorly on the female thorax (Fig. 3.5), which interlock in courtship, as was the case of the illustrated type pair. While the two species shown in Fig. 3.4 are widespread in Africa, with *M. singularis* collected at the same site as the new species, two others species of *Mesocnemis* are only known from Senegambia and Liberia respectively. The new species may be endemic to the Congo River, where it was discovered.

A third probable new species belongs to the difficult genus *Elattoneura*, but this genus is also present in the MRAC collections. The observed specimens of *C. trifaria* do not conform with typical populations of that species (Fig. 3.3a). A female *Lestinogomphus,* found emerging from the Congo River, seems larger than any known species, but the genus's taxonomy is fragmentary and based on male characters.

As stated, the richness of the Lokutu fauna lies in running-water forest species: the relative diversity of species of this

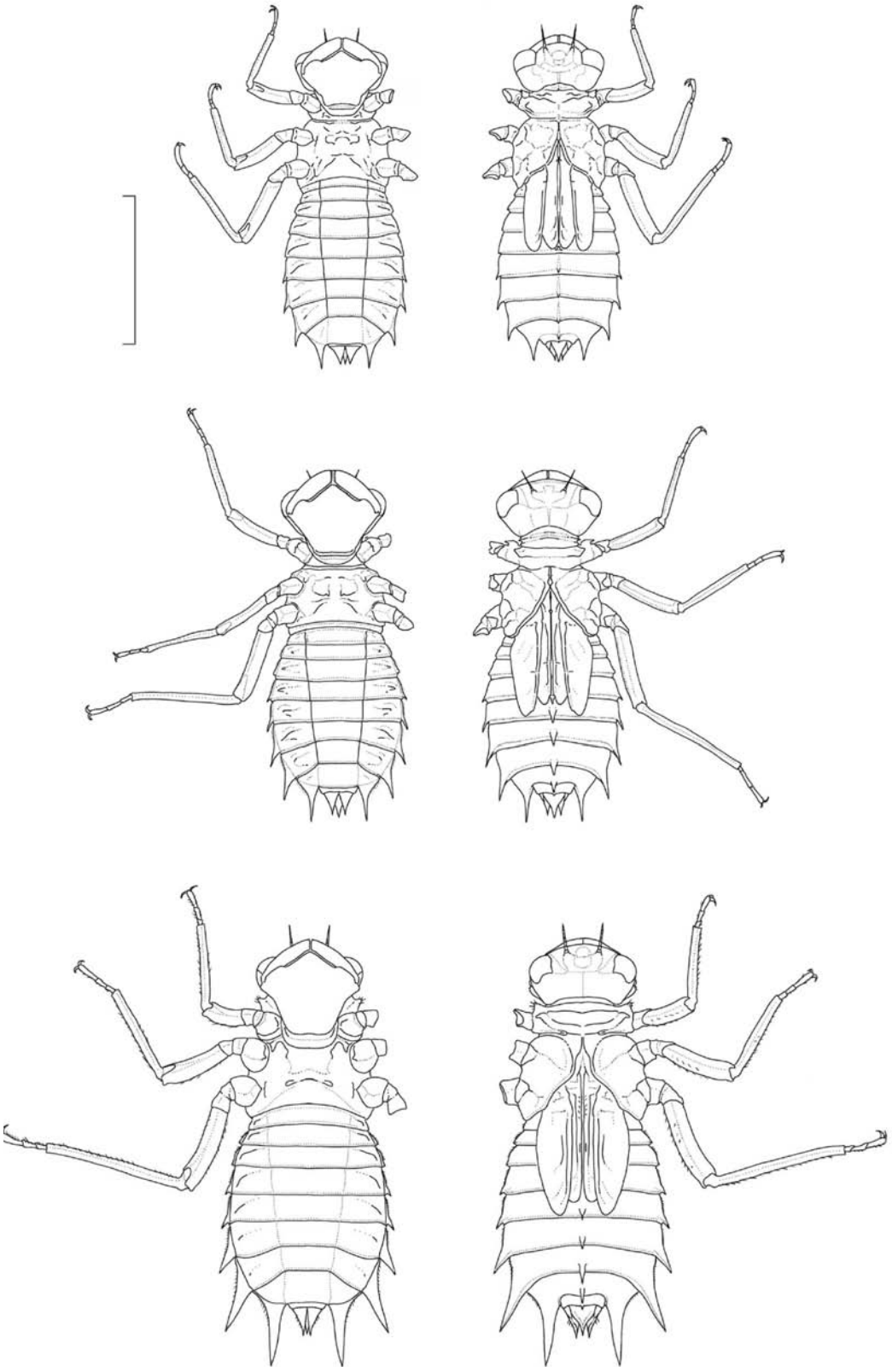


Figure 3.2. Ventral (left) and dorsal (right) view of larval exuviae of the three continental *Afrotropical Zygonoides* species, from top to bottom *Z. fuelleborni, Z. fraseri* and *Z. occidentis*. The latter was the last to be discovered, at Lokutu. *Zygonoides* is an example of an openland taxon (inhabits large rivers), which has a Congo Basin representative that is large and dark (in the adult). The scale represents 10mm. Drawings by Ole Müller.

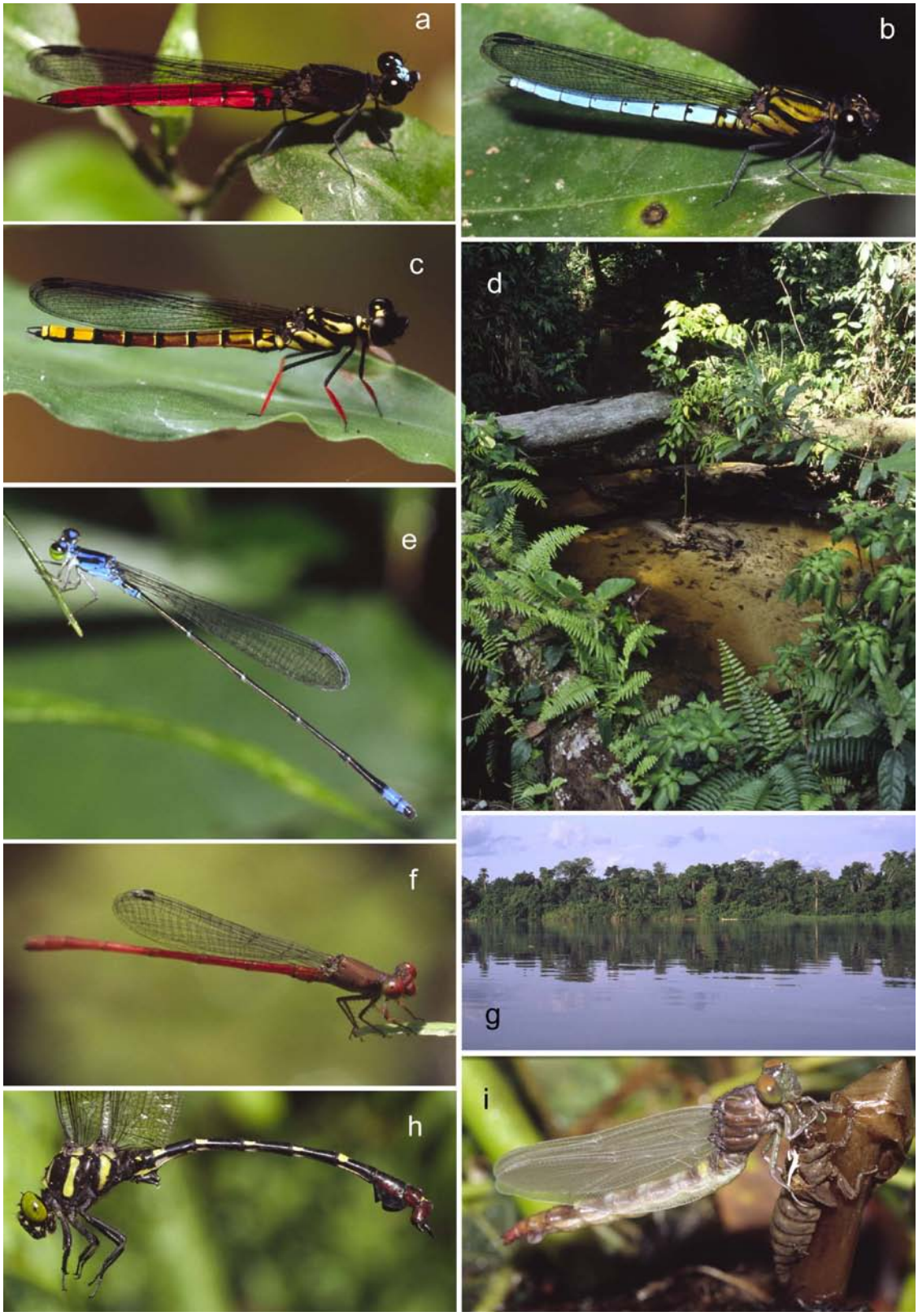


Figure 3.3. Some odonatological highlights at Lokutu: (a) male *Chlorocypha* cf. *trifaria*; (b) male *Chlorocypha aphrodite*; (c) male *Platycypha* spec. nov.; (d) Letissé River, the type locality of *Platycypha* spec. nov.; (e) male *Pseudagrion simplicilaminatum*; (f) male *Ceriagrion ignitum*; (g) forested bank of Congo River; (h) male *Phyllogomphus coloratus* in the hand; (i) emerging female *P. coloratus*. All photos by K.-D.B. Dijkstra.

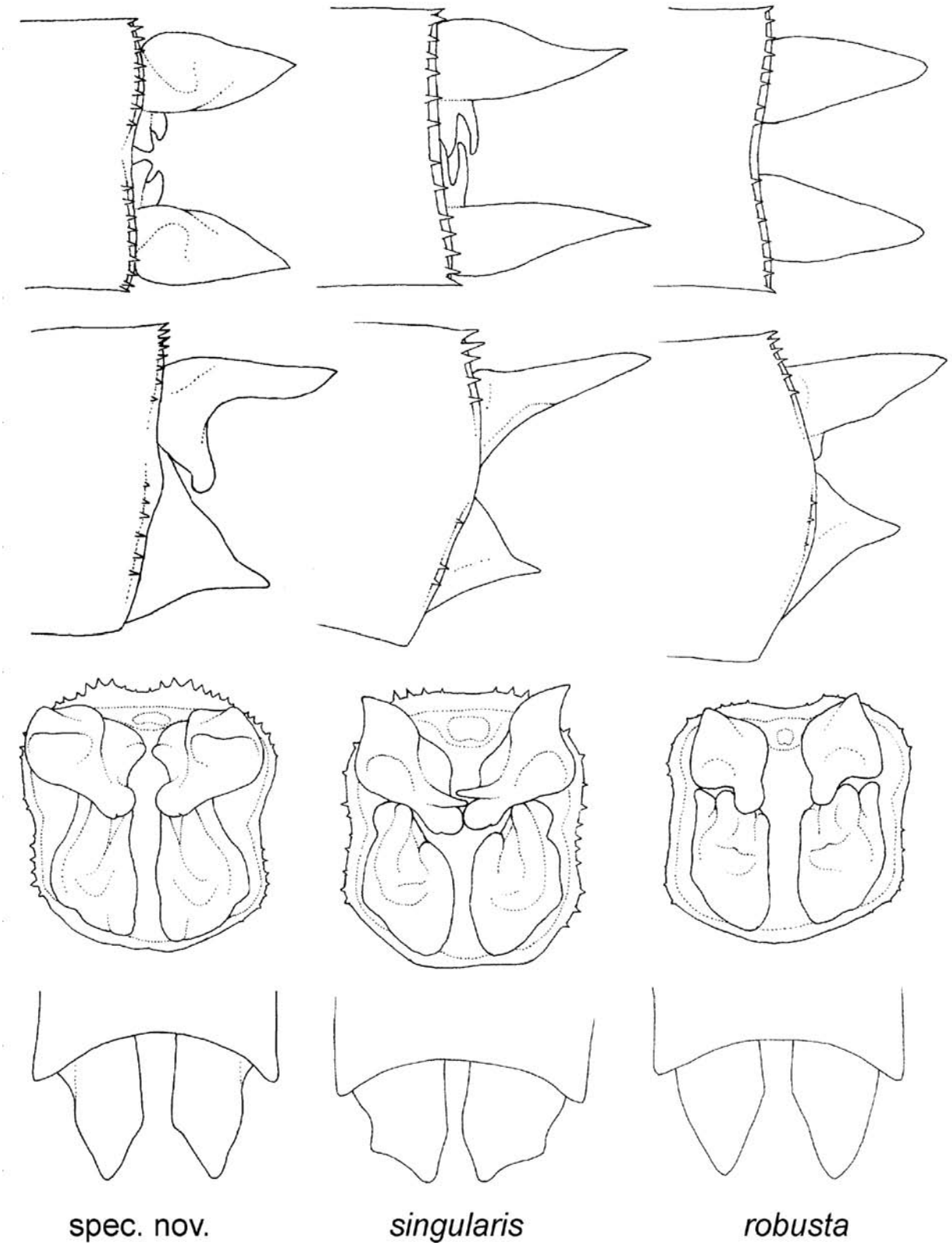


Figure 3.4. *Mesocnemis* male appendages (cerci and paraprocts), from top to bottom in dorsal (paraprocts omitted), lateral, caudal and ventral view (cerci omitted).

specialization (at least 32 species, which is 37% of recorded species) lies above that of Semliki (23, 25%) and Bwindi (23, 35%). Within this community, only the Zygoptera can be readily surveyed thoroughly and for this group data are available to describe the ecological segregation of the species (Table 3.3): openness is the main determinant of habitat selection, both at a large (water body size) and a fine scale (shading of banks). The obligate stream-dwelling families Calopterygidae and Chlorocyphidae showed marked segregation of species, with seldom more than one species of each at a site. Of the small 'coenagrionoid' families, Coenagrionidae *s.s.* are concentrated in the calmer, more open habitats, with a distinct separation between the A- and B-groups of Africa's dominant damselfly genus *Pseudagrion*, while the other two families are most speciose at the shaded small stream end of the habitat gradient. Dijkstra and Lempert (2003) found a similar pattern in West Africa, with a somewhat different mix of species (usually in the same genera) occupying niches.

For the running-water anisopterans the picture is still fragmentary. One of the survey's most interesting results is

Table 3.3. Ecological segregation of damselflies (Zygoptera) observed at Lokutu, DRC. Two families are combined because taxonomic limits are uncertain. The positions of two species that were not found at the waterside are assumed. Macrohabitat is indicated in columns. Microhabitat is indicated by shading: dark gray — found in predominantly shaded areas, light gray — found in half-open areas, or none — found in largely open areas.

	Small streams	Large streams and small rivers	Large rivers	Standing water
Calopterygidae	*Umma saphirina*	*Umma longistigma* *Umma cincta* ?	*Phaon camerunensis*	
Chlorocyphidae	*Chlorocypha* cf. *trifaria*	*Chlorocypha aphrodite* *Platycypha* sp. nov.	*Chlorocypha pyriformosa*	
Protoneuridae + Platycnemididae	*Prodasineura vittata* *Elattoneura centrafricana* *Chlorocnemis cyanura* *Chlorocnemis nigripes* *Chlorocnemis pauli*	*Elattoneura* sp. nov.	*Mesocnemis* sp. nov. *Mesocnemis singularis*	*Prodasineura nyansana*
Coenagrionidae	*Pseudagrion* (A) *kibalense*	*Pseudagrion* (A) *simplicilaminatum* *Pseudagrion* (A) *superbum* *Pseudagrion* (A) *melanicterum*	*Pseudagrion* (B) *glaucum* *Pseudagrion* (B) *sjoestedti* *Pseudagrion* (B) *nubicum*	*Agriocnemis stygia* ? *Agriocnemis forcipata* *Agriocnemis maclachlani* *Ceriagrion corallinum* *Ceriagrion glabrum* *Ceriagrion ignitum*

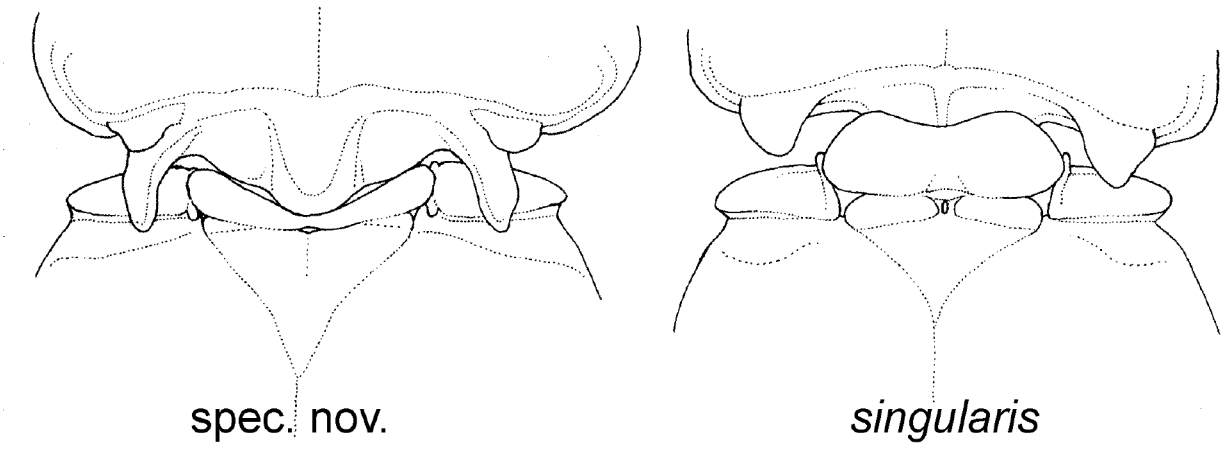


Figure 3.5. *Mesocnemis* female hind margin of pronotum and mesostigmal region of synthorax in dorsal view.

the diverse gomphid community found on the huge Congo River (3–3.5 km across at Lokutu, fragmented by numerous islands, Fig. 3.3g). Because adults emerge at night and rarely come to water, mature adults of river gomphids are seldom collected. Dusk is possibly the main time for reproductive activity, which may largely take place above the water far from the banks: in the case of the Congo River, 1 km or more from the water's edge. Nonetheless, a couple of hours spent coursing the river at dusk and scouring the banks around midnight and in the morning revealed (mostly through emerging adults and larval exuviae) that seven species in seven different (sub)genera (probably) reproduce in the river: *Gomphidia bredoi*, *Ictinogomphus regisalberti*, *Lestinogomphus* sp., *Neurogomphus* (*Mastigogomphus*) cf. *chapini*, *N.* (*Neurogomphus*) cf. *uelensis*, *Paragomphus acuminatus* and *Phyllogomphus coloratus* (Fig. 3.3i). The discovery of the aberrant and previously unknown larvae of the very distinctive subgenus *Mastigogomphus* of *Neurogomphus*, and the atypical *P. acuminatus* were among the taxonomically most significant findings of the survey.

Odonates were the only invertebrate group included in the RAP survey. Moreover, they differ from most other groups studied in that they are not actively exploited (i.e., not hunted or logged) and in their strong ties to water. They, therefore, serve to assess the more indirect anthropogenic disturbance by man: the gradual alteration of the landscape. The rich and 'intact' (i.e., no unexplained gaps in Table 3.3) forest stream community of Odonata found in the Lokutu area suggests a healthy watershed, with limited degrees of pollution and streambed erosion. Indeed, most streams, including those within the plantation, were forested. Those that were not had poor assemblages consisting mainly of widespread species. As long as forest cover and natural stream morphology are retained, the rich dragonfly fauna is expected to persist. The obtained species list, which represents about one-tenth of described Afrotropical Odonata,

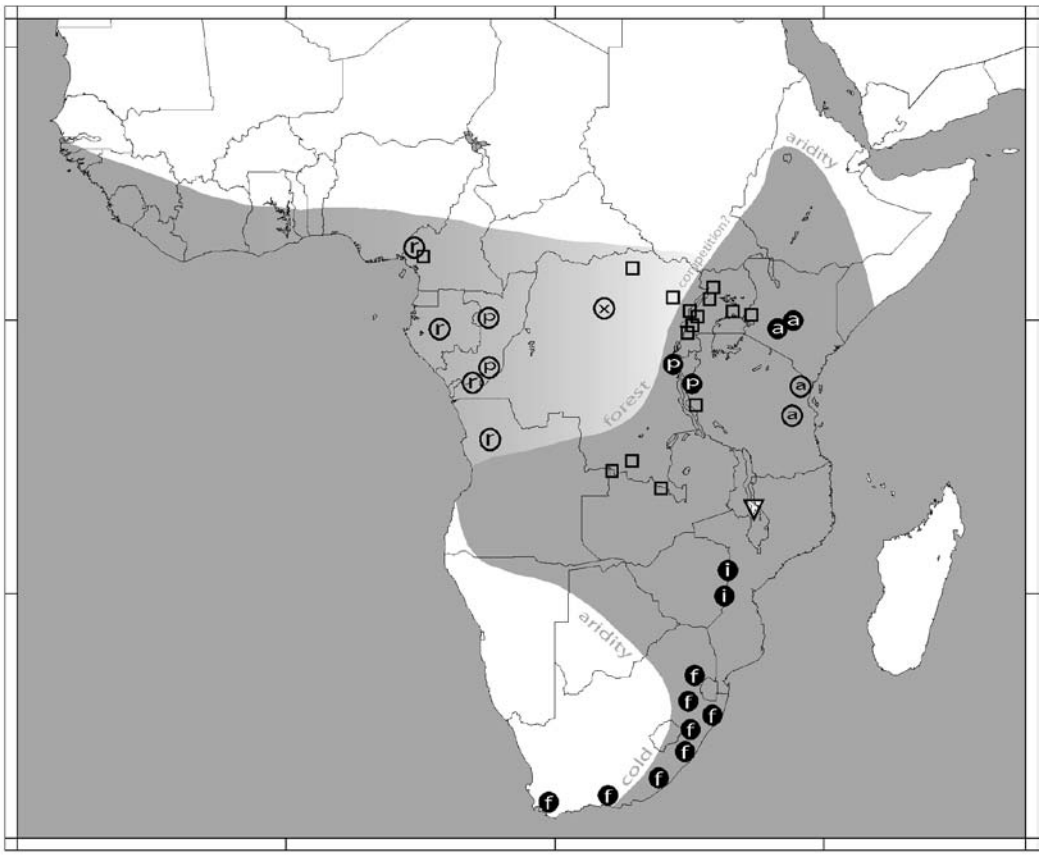


Figure 3.6. Distribution of *Platycypha*. Open circles: relictual species of lowland occurrence (a: *P. auripes*; p: *P. picta*; r: *P. rufitibia*; x: new species found at Lokutu). **Black circles:** relictual species of submontane occurrence (a: *P. amboniensis*; f: *P. f. fitzsimonsi*; i: *P. f. inyangae*; p: *P. pinheyi*). **Squares:** *P. lacustris*. **Dark shading:** *P. caligata*, the only truely non-forest species of the family Chlorocyphidae in Africa, with possible factors limiting its spread westwards indicated. **Triangle:** Aberrant lacustrine population of *P. caligata* (all other family members are strictly riverine). **Paler shading:** main range of other Chlorocyphidae (areas with two or more species), mostly Chlorocypha, outside that of *Platycypha*.

is especially long considering the paucity of standing water species of both forested and open habitats. The absence of numerous well-dispersing open land species suggests that the extensive forest that still surrounds Lokutu may form an insurmountable barrier.

None of the recorded species are included in the global Red List. In contrast to northern, eastern and southern Africa, the Odonata of central and western Africa have not yet been assessed, as data is either limited or fragmented (Dijkstra and Vick 2004). Nonetheless, none of the recorded species are likely threatened. Moreover, the area does not support certain Congolian endemics, probably because their habitat is absent (see above). I believe that the observed richness is typical of the Basin as a whole and therefore the Lokutu area does not require specific conservation action. Indeed, considering observed gaps in the Odonate assemblage, other areas are expected to be even richer.

The main message that follows from the survey of Lokutu's Odonata is not about the study area, but about the study group. This was the first RAP survey in Africa to include Odonata, and it proved possible to obtain a fair picture of the local diversity within a short period of time (Table 3.2), even allowing a partial description of their ecology (Table 3.3). This picture indicated a rich and apparently largely natural fauna, which probably represents high overall aquatic biodiversity, contrasting sharply with the impoverished and imperiled fauna and flora indicated by the other groups studied. Because of their 'information-rich' potential, I recommend that Odonata are placed more at the forefront of RAP and conservation policy. The group is very 'RAPable' and is complementary to traditional RAP taxa, such as large mammals. Particularly in the Congo Basin, the largest and probably most intact forest-water ecosystem in Africa, an emphasis on Odonate research seems beneficial as a baseline for biodiversity and watershed conservation. Sampling a network of sites (Fig. 3.1) for these charismatic insects (Fig. 3.3) can demonstrate whether existing conservation priorities in the Basin also protect its freshwater biodiversity.

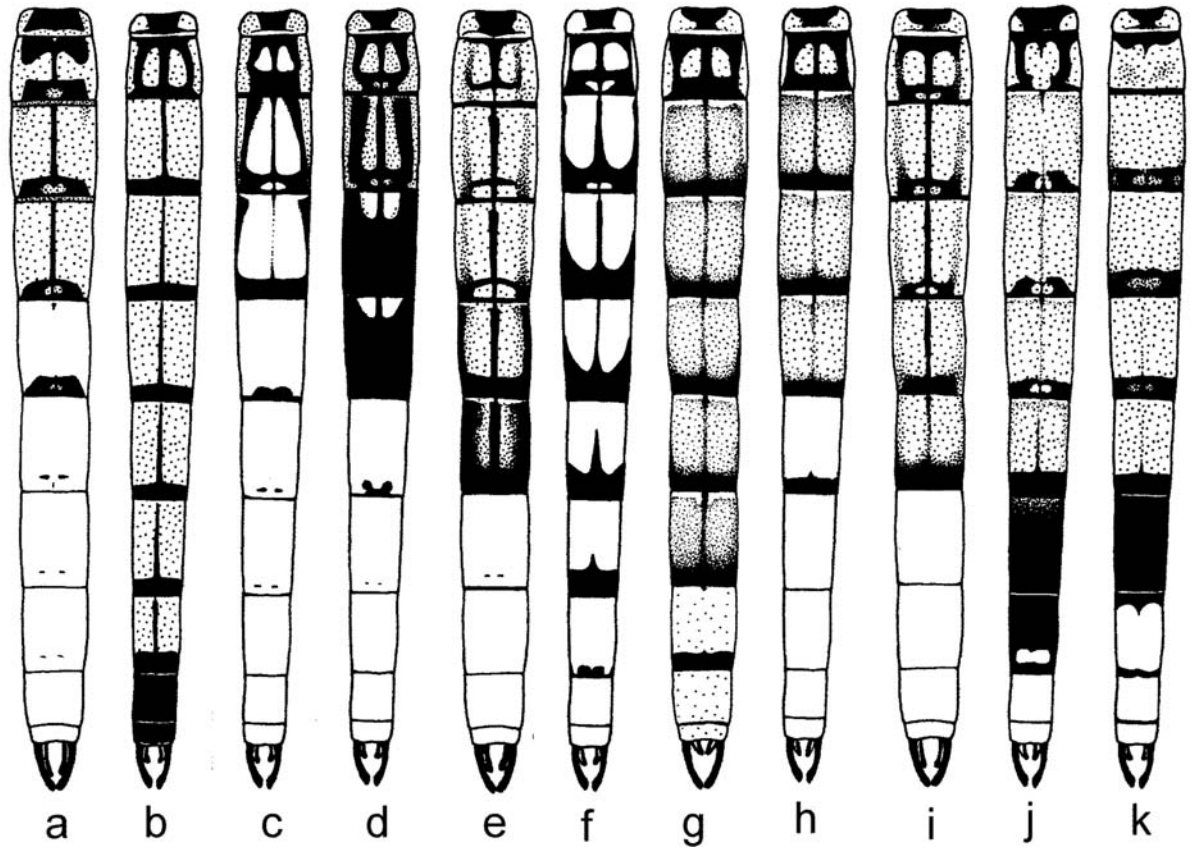


Figure 3.7. Platycypha male abdomens in dorsal view. Dotted areas are yellow to brown or red, undotted blue. (a) *P. amboniensis;* (b) *P. auripes;* (c) *P. caligata* typical; (d) *P. caligata* aberrant lacustrine form; (e) *P. fitzsimonsi;* (f) *P. lacustris;* (g) new species found at Lokutu; (h) *P. picta;* (i) *P. pinheyi;* (j) dark *P. rufitibia,* Cameroon; (k) pale *P. rufitibia,* Angola.

REFERENCES

Carletti, B. and F. Terzani. 1997. Descrizione di *Pseudagrion simplicilaminatum* spec. nov. della Repubblica del Congo (Odonata: Coenagrionidae). Opuscula zoologica fluminensia 152: 1–7.

Clausnitzer, V. and K.-D.B. Dijkstra. In prep. The dragonflies of Eastern Africa (Odonata), an identification key. Studies in Afrotropical Zoology.

Clausnitzer, V. 2003. Dragonfly communities in coastal habitats of Kenya: indication of biotope quality and the need of conservation methods. Biodiversity and Conservation 12: 333–356.

Corbet, P.S. 1999. Dragonflies: Behaviour and Ecology of Odonata. Harley Books, Colchester.

Dijkstra, K.-D.B. 2003. Problems in *Chlorocypha* classification: four cases from West Africa and a discussion of the taxonomic pitfalls (Odonata: Chlorocyphidae). International Journal of Odonatology 6: 109–126.

Dijkstra, K.-D.B. 2005. Taxonomy and identification of the continental African *Gynacantha* and *Heliaeschna* (Odonata: Aeshnidae). International Journal of Odonatology 8: 1–33.

Dijkstra, K.-D.B. 2006. A review of continental Afrotropical *Ceriagrion* (Odonata: Coenagrionidae). Journal of Afrotropical Zoology 2: 3–14.

Dijkstra, K.-D.B., V. Clausnitzer and G.S. Vick. 2006. Revision of the three-striped species of *Phyllogomphus* (Odonata, Gomphidae). Tijdschrift voor Entomologie 149: 1–14.

Dijkstra, K.-D. B. and J. Lempert. 2003. Odonate assemblages of running waters in the Upper Guinean forest. Archiv für Hydrobiologie 157: 397–412.

Dijkstra, K.-D. B. and V. Clausnitzer. In prep. An annotated checklist of the dragonflies (Odonata) of Eastern Africa, with critical lists for Ethiopia, Kenya, Malawi, Tanzania and Uganda, new records and taxonomic notes.

Dijkstra, K.-D.B. and G.S. Vick. 2004. Critical species of Odonata in western Africa. *In*: Clausnitzer, V. and R. Jödicke (eds). Guardians of the Watershed. Global status of dragonflies: critical species, threat and conservation. International Journal of Odonatology 7: 229–238.

Kingdon, J. 1989. Island Africa. Princeton University Press, Princeton.

Chapter 4

Amphibians and Reptiles of Lokutu

Johannes Penner and Mark-Oliver Rödel

SUMMARY

During a short rapid assessment survey (RAP) of the Lokutu region, Democratic Republic of Congo, we recorded 21 species of amphibians and 16 species of reptiles. Most species were common savannah or forest species which can adapt to a high level of anthropogenic disturbance. The known distributional range for six amphibian species (*Afrixalus equatorialis*, *Amnirana amnicola*, *Cardioglossa gratiosa*, *Dimorphognathus africanus*, *Hyperolius* cf. *lateralis* and *Leptopelis ocellatus*) has been extended. Given the circumstances of this RAP survey (i.e., inaccessibility of potentially pristine forest patches), the species list reported here does not allow for meaningful conservation recommendations.

INTRODUCTION

Most amphibians and reptiles have very specific habitat requirements and are, therefore, excellent habitat indicators. Amphibians, especially, represent other biodiversity (e.g., phytodiversity) very well (W. Küpper et al. unpubl. data). However, their performance as habitat indicators is best in humid areas. Reptiles are highly valuable indicators for arid areas. Hence the combination of both groups effectively reflects the state of an area under investigation.

However, the potential value of amphibians and reptiles as indicators is limited by the lack of knowledge concerning the biology, taxonomy and distribution of many species. As with other groups of organisms, the herpetofauna of most parts of DRC remains largely unknown. The only comprehensive herpetological work dates back to 1919, 1923 and 1924 (Schmidt and Noble 1998). Therefore, the distribution maps for many species, well documented, for example, in Cameroon and Uganda, still show large gaps in Central Africa. It is currently unclear whether this is due to missing data or represents real distributional gaps. Hence, our predominant aim during this survey was to provide a first assessment of the herpetological diversity of the region, contributing to a better understanding of the distribution and taxonomy of Central African amphibians and reptiles.

MATERIAL AND METHODS

Study sites

From 26 October to 9 November 2004 we searched for amphibians and reptiles mainly in three areas (For details on study sites, see Introduction and Map in this report).

Site 1. Lokutu. The area described as 'Lokutu' refers to the village itself, formerly known as Elisabetha. In this area (N 01°08'43.4''/E 23°36'54.1'') we found several potential amphibian breeding sites. Open water in the village was permanently available in the form of an old swimming pool. The pool was no longer in use but continuously provided a shallow pond. Close to this habitat a leaking water pipe provided a small muddy area (ca. 50 m²). Old

concrete water tanks (the old filtration system of the pool) still contained water. Water there was heavily vegetated. Close to the village we investigated a series of five fish ponds (each ca. 5 m diameter), situated in a steep valley of a small river. This site was close to the Congo River.

Site 2. Lobolo. The second collecting site (including Lobolo Camp, N 00°55'44.0"/E 23°32'26.6") was situated in a clearing inside heavily degraded forest. Adjacent fields and a small river, as well as several puddles along the road, were searched for amphibians and reptiles. The area was partially flooded due to heavy rains.

Site 3. Lothi. No collections were made at this site (N 00° 55' 41.7"/E 23° 32' 27.5") due to restrictions imposed by local officials and policemen.

Site 4. Lukumete. This site stretched from the camp-site along a transect (positioned from N 01°17'28.7"/E 23°25'51.7" to 01°17'35.2"/E 23°23'21.5") towards the west up to the (medium-sized) Lunua River. There we investigated two rivers and several swamps in proximity to the camp. A third river, crossing the transect approximately 1 km before joining the Lunua River, was also searched. A substantial part of this area was dominated by the tree *Gilbertiodendron dewevrei.*

Collecting methods

We searched for reptiles and amphibians primarily using opportunistic visual and acoustic search techniques during day and night, often using line transects (aligned from East to West) on established paths. With this method only semi-quantitative presence / absence data can be gathered. The most appropriate method for a standardized inventory would have been searching along established plots/transects including mark-recapture experiments (Rödel and Ernst 2004). However, due to time limitations it was not possible to apply these methods. The length of our 'random' transect ranged from 1.4–3.8 km, leaving *search hours per person* as the only standard parameter. To complete the inventory, especially to detect fossorial and cryptic species, a variable number of funnel traps (height × width x length: 0.4 × 0.2 × 1.0 m) were aligned either along natural barriers or along drift fences made out of plastic garbage bags (height: 1 m, total length: 15 m) and buried 5 cm into the soil (Table 4.1).

In total, sampling took place over 13 days and 14 nights. Transect walks were only possible at one site (site 4, Lukumete) during four days. Transects were walked in total for 19 hours during the night and 20 hours during the day. Trap days totaled 108 (Table 4.1). RAP team members provided further specimens, as encountered, during their own survey work.

Voucher specimens were killed in a solution of MS222 (3-Aminobenzoic Acid Ethyl Ester Methanesulfonate; Sigma-Aldrich Chemie GmbH, Germany). Afterwards, photographs and tissue samples were taken. Tissue samples were stored in 97% ethanol, specimens were fixed in 4% formaldehyde and eventually transferred to 70% ethanol. All specimens are currently stored in the research collection of M.-O. Rödel at the University of Würzburg, Germany, and will be deposited later in various natural history museums.

Determination was done after Schiøtz (1999) for treefrogs and Chippaux (2001) for snakes. Taxonomy follows Frost (2004) for amphibians and Uetz et al. (2004) for reptiles. Common names are after Frank and Ramus (1995).

RESULTS

We recorded a total of 21 species of amphibians belonging to five families (Table 4.2). Within the family Arthroleptidae, we recorded only one species; however, the Long-Toed Frog (*Cardioglossa gratiosa*) was a new record for the DRC. Previously, *C. gratiosa* was known only from Cameroon, Equatorial Guinea, Gabon and parts of Congo Brazzaville (IUCN 2004). An unpublished record from Dzanga-Sangah Reserve, Central African Republic (M.-O. Rödel unpubl. data), indicates that the species most likely is widespread in the Central African rainforests.

Within the true toads (Bufonidae), two species (*Bufo maculatus*, *B. regularis*) represent typical savannah forms which regularly invade anthropogenically disturbed forests (e.g., Rödel 2000). The other three species are forest toads, inhabiting primary and secondary forests. *Bufo gracilipes* seems to prefer very swampy parts of the forest.

Of the seven recorded treefrogs (Hyperoliidae), four records are large range extensions (*Afrixalus equatorialis*, *Cryptothylax gresshoffi*, *Hyperolius* cf. *lateralis* and *Leptopelis ocellatus*). However, all four species are likely to occur throughout the Congo Basin. The African Swamp Frog (*Dimorphognathus africanus*, Petropedetidae) was found within Lokutu village (site 1), although it has previously been reported only from forests. One ranid frog, *Amnirana amnicola*, also represents a new species for the DRC.

Table 4.1. Number of funnel traps placed to capture reptiles and amphibians at two sites in the Lokutu region, DRC.

Site	Traps along natural barriers	Traps along drift fence	Other traps	Total trap/days
Lobolo camp (site 2)	20	0	0	20
Lukumete camp (site 4)	4	16	2	88

We found 16 reptile species during our survey (Table 4.3). Good evidence for the presence of an additional four species was provided by locals (species indicated with an asterisk in Table 4.3). These taxa are easy to identify and hence confusion with other species is unlikely. Only the tortoise, *Kinyxis belliana*, a tree-dwelling *Agama* sp., and *Mabuya maculilabris* are considered non-forest species (e.g., Spawls et al. 2002). Both large vipers (*Bitis gabonica gabonica* and *B. nasicornis*) are regularly caught within the plantations and consumed by farm workers. *B. g. gabonica* reach high densities in plantations at some sites (Lawson 1993). Crocodiles (*Crocodylus cataphractus, C. niloticus*) were reported to occur, though both species were described as very hard to find. This shyness is likely due to high hunting pressure by the local population.

DISCUSSION

Most of the Lokutu concession consists of oil palm plantations, areas used for agriculture, or heavily degraded and heavily hunted forest. The inventory of amphibians and reptiles mirrors this state very well. Common savannah species were present in the highest abundances and true forest species were rarely encountered.

Although it was not possible to investigate the patches of pristine forest of this area (and heavy rainfall was rare during the survey period), we conclude that the herpetofauna of the sites we did survey was impoverished. One major factor is hunting by the local population of all of the larger reptiles (e.g., crocodiles, Nile monitors, tortoises, and larger snakes). The snake fauna, especially around the villages, also suffers due to the fact that every legless snake-like reptile is killed immediately upon sight. Other major direct threats to amphibians and reptiles are the free-roaming chickens and pigs, which feed readily on any amphibian or reptile they encounter.

The time available for this survey was much too short to assume that the local herpetofauna was completely assessed. The snake fauna, especially, is surely undersampled, and additional frog species can be expected to be found during periods of heavier rainfall. Nevertheless, range extensions for several species show that even this comparatively poor fauna

Table 4.2. Amphibian species recorded during the RAP survey of the Lokutu region, DRC.

Family	Species	Site
Arthroleptidae	*Cardioglossa gratiosa* Amiet, 1972	Lukumete (site 4)
Bufonidae	*Bufo camerunensis* Parker, 1936	Lukumete (site 4)
	Bufo gracilipes Boulenger, 1899	Lukumete (site 4)
	Bufo cf. *latifrons* Boulenger, 1900	Lokutu (site 1), river bank
	Bufo maculatus Hallowell, 1854	Lokutu (site 1), pool
	Bufo regularis Reuss, 1833	Lokutu (site 1), pool
Hyperoliidae	*Afrixalus* cf. *fulvovittatus* (Cope, 1861)	Everywhere
	Afrixalus equatoralis (Laurent, 1941)	Lukumete (site 4)
	Cryptothylax gresshoffi (Schilthuis, 1889)	Lokutu (site 1), river bank
	Hyperolius cf. *lateralis* Laurent, 1940	Lukumete (site 4)
	Leptopelis cf. *omissus* Amiet, 1991	Lukumete (site 4)
	Leptopelis ocellatus (Mocquard, 1902)	Lukumete (site 4)
	Leptopelis sp.	Lukumete (site 4)
Petropedetidae	*Dimorphognathus africanus* (Hallowell, 1858)	Lokutu (site 1), tank
	Phrynobatrachus aff. *accraensis* (Ahl,1925)	Lokutu (site 1), tank
	Phrynobatrachus sp.	Lukumete (site 4)
Ranidae	*Amnirana amnicola* (Perret, 1977)	Lukumete (site 4)
	Amnirana galamensis (Duméril & Bibron, 1841)	Lokutu (site 1), river bank
	Hoplobatrachus occipitalis (Günther, 1858)	Lokutu (site 1)
	Ptychadena cf. *perreti* (Guibé & Lamotte, 1958)	Lobolo (site 2)
	Ptychadena cf. *taenioscelis* (Laurent, 1954)	Lokutu (site 1)

Table 4.3. Reptile species recorded during the RAP survey of the Lokutu region, DRC.

Family	Species	Site
Testudinidae	*Kinyxis* cf. *belliana* Gray, 1831	Lukumete (site 4), #
	Kinyxis erosa Schweigger, 1812	Lukumete (site 4), #
Agamidae	*Agama* sp.	Lokutu (site 1)
Gekkonidae	*Hemidactylus* cf. *mabouia* (Moreau de Jonnès, 1818)	Lokutu (site 1)
Lacertidae	*Holaspis* cf. *guentheri* Gray, 1863	Lukumete (site 4)
Scincidae	*Feylinia* sp.	Lokutu (site 1), #
	Trachylepis maculilabris (Gray, 1845)	In plantations and fields (in and between all sites)
	Leptosiaphos sp.	Lukumete (site 4)
	Trachylepis sp.	Lokutu (site 1)
Varanidae	*Varanus niloticus* (Linnaeus, 1758)	Lokutu (site 1), river bank
Boidae	*Python* cf. *sebae* (Gmelin, 1789)	Lukumete (site 4), #
Colubridae	*Chamaelycus* sp.	Lukumete (site 4)
	Lamprophis cf. *fuliginosus* (Boie, 1827)	Lukumete (site 4)
	Philothamnus heterolepidotus (Günther, 1863)	Lokutu (site 1)
Elapidae	*Dendroaspis jamesoni jamesoni* (Traill, 1843)	Lokutu (site 1), river bank
Viperidae	*Atheris squamigera* (Hallowell, 1854)	Lukumete (site 4), Lokutu (site 1), #
	Bitis gabonica gabonica (Duméril, Bibron & Duméril, 1854)	*
	Bitis nasicornis (Shaw, 1802)	*
	Causus lichtensteinii (Jan, 1859)	Lukumete (site 4), #
Crocodylidae	*Crocodylus cataphractus* Cuvier, 1825	*
	Crocodylus niloticus Laurenti, 1768	*

Symbols:
- specimens collected by local people
* - no specimens collected but described by local people

can add significantly to our knowledge of the herpetofauna of the Congo Basin.

In summary, from the herpetological point of view, we cannot recommend investing further money or other resources into the Unilever concession at Lokutu in the territory of Basoko. The status of biodiversity within the forest in the Territory of Yahuma remains unknown. However, this study from Basoko suggests that the forest of the Territorky of Yahuma will also be heavily degraded. Additional problems in the Yahuma Territory include the corruption, disinterest and inflexibility of the local administration, making it very difficult or impossible to work there. The biggest problem in the area seems to be rapid population growth and the related habitat degradation and destruction. Significant actions are required to prevent increasing pressure on the few remaining forests.

REFERENCES

Chippaux, J.-P. 2001. Les serpents d'Afrique occidentale et centrale. IRD Éditions. Paris, France.

Frank, N. and E. Ramus. 1995. Complete Guide to the Scientific and Common Names of the Amphibians and Reptiles of the World. NG Publishing Inc. Pottsville, USA.

Frost, D.R. 2004. Amphibian Species of the World: an Online Reference. Vers. 3.0. 22 Aug. 2004. Web site : http://research.amnh.org/herpetology/amphibia/index.html.

IUCN, Conservation International, and NatureServe. 15 Oct. 2004. Global Amphibian Assessment. Web site: http://www.globalamphibians.org.

Lawson, D.P. 1993. The reptiles and amphibians of the Korup National Park Project, Cameroon. Herpetological Natural History 1: 27–90.

Rödel, M.-O. 2000. Herpetofauna of West Africa. Vol. I: Amphibians of the West African Savanna. Chimaira. Frankfurt, Germany.

Rödel, M.-O. and R. Ernst. 2004. Measuring and monitoring amphibian diversity in tropical forests. I. An evaluation of methods with recommendations for standardization. Ecotropica 10: 1–14.

Schiøtz, A. 1999. Treefrogs of Africa. Chimaira. Frankfurt, Germany.

Schmidt, K.P. and G. K. Noble. 1998. Contributions to the Herpetology of the Belgian Congo. Reprint by the SSAR. USA.

Spawls, S., K. Howell, R. Drewes and J. Ashe. 2002. A Field Guide to the Reptiles of East Africa. Academic Press. San Diego, USA.

Uetz, P., R. Chenna, T. Etzold and J. Hallermann. 2004. The EMBL reptile database (01 Nov. 2004). Web site: http://www.reptiliaweb.org.

Chapter 5

A Rapid Survey of the Avifauna of Lokutu

Brian Finch, Thomas M. Butynski and Klaas-Douwe B. Dijkstra

SUMMARY

This report presents the results of a survey by Conservation International's Rapid Assessment Program (RAP) of the birds at Lokutu, Democratic Republic of the Congo. This survey was conducted from 26 October to 8 November 2004. The birds listed in this report were encountered in the field during reconnaissance walks and from camp. We found 204 species of birds at Lokutu, of which 20 species are Palearctic migrants. No bird species listed as threatened on the 2004 IUCN Red List of Threatened Species was encountered. We documented previous logging activity, past and ongoing wide-scale conversion of forests to oil palm plantations and gardens, and heavy hunting pressure. Our findings indicate that the Lokutu area is of relatively low value as a site for the conservation of birds. This is due, in part, to a decline in the bird species richness of the site as a result of forest degradation, fragmentation, and clearance, together with unsustainable levels of hunting of some species. A preliminary list of the birds of the Lola ya Bonobo Sanctuary (near Kinshasa) is presented at the end of this report.

INTRODUCTION

Lokutu (formerly named 'Elizabetha'), Democratic Republic of Congo (DRC), lies on the southern boundary of the northern-most extent of the Congo River and still has forested areas, some of them within Unilever's Lokutu Oil Palm Plantation concession. The vast forested area to the south of the Congo River is known to support a rich diversity of bird species and is part of the Congo Basin High Biodiversity Wilderness Area (Myers et al. 2000, Mittermeier et al. 2003).

The birds present in the vicinity of Lokutu have never been documented. Situated deep within the Congo Basin, adjacent to the south (left) bank of the Congo River, the expectation was that Lokutu would hold a high diversity of bird species — including a number of threatened species. As such, a Rapid Assessment Program (RAP) survey of the birds, as well as of the plants, dragonflies, amphibians, reptiles, primates and larger mammals, was undertaken in 2004. The objective of the RAP at Lokutu was to provide quick, efficient, reliable, and cost-effective biodiversity data on this little-known part of DRC in support of a regional conservation strategy.

METHODS

For details on study sites, see Introduction and Map in this report. The taxonomy and vernacular names used in this report follow Sinclair and Ryan (2003).

All of the data on birds were collected during 'reconnaissance surveys' (White and Edwards 2000, Newing et al. 2002) and opportunistically from camp. Most of the reconnaissance surveys were conducted on the ground following the 'line of least resistance' (usually footpaths

and dirt roads) through the vegetation so as to cover as much ground as possible. Some reconnaissance surveys were conducted during boat trips on the Congo River. Our 'goal' was to maximize the number of bird species encountered. Since bird distributions are often extremely patchy, it was critical that we covered as much area and as many vegetation types as possible (Bennun and Howell 2002). Most of our time at Lokutu was spent on reconnaissance surveys. These were conducted primarily during the daylight hours, but also during the few hours before dawn and during the several hours after sunset. All bird species seen or heard were recorded, and notes on flock size, abundance, vegetation type, and human disturbance were made.

No attempt was made to assess absolute abundance for any of the bird species encountered. For the less common species, we did, however, record the total number of contacts and/or individuals encountered during our time at Lokutu. Furthermore, in the species list presented in Appendix 3, we compare our 'impressions' of abundance of each species found at Lokutu with our considerable experience with that of species in eastern Africa. In other words, for each species present both at Lokutu and in eastern Africa, we assess 'relative abundance' between the two areas. In making our assessments of relative abundance, we took into consideration the amount of time spent in suitable habitat and the characters of the species that make it easy or difficult to detect (e.g., frequency of calls, distance at which calls can be heard, whether in sparse or dense vegetation, whether a secretive and/or cryptic species).

RESULTS

We encountered 204 species of birds at Lokutu (Appendix 3). Of these, 20 species are Palearctic migrants that are not known to have resident populations in sub-Saharan Africa. None of the 204 species is listed as a 'Globally Threatened Species' or as a 'Restricted Range Species' (Demey and Louette 2001, Fishpool and Evans 2001), and none is on the 2004 Red List of Threatened Species (IUCN 2004).

Based on the birds listed in Appendix 3, Lokutu supports at least 18% of the approximately 1,117 species of bird recorded for the DRC (Demey and Louette 2001).

During this study, we obtained geographic range extensions for 14 species and one subspecies (see Appendix 3 and below).

We failed to find a single species of Guineafowl, Francolin, Quail, Goose, Crane, Nightjar, Helmet-shrike, Cuckoo-shrike, Mousebird, Wood-Hoopoe, Oriole, Lark, Pipit, Firefinch, Canary, Apalis, Tit, Penduline Tit, Pytilia or Twinspot. The African Finfoot *Podica senegalensis* and Congo Peacock *Afropavo congensis* were not encountered. In addition, the following taxonomic groups of birds were represented by but one, or relatively few, species: Ducks, Storks, Owls, Bee-eaters, Woodpeckers, Babblers, Honeyguides, Muscicapine Flycatchers, True Shrikes, Thrushes, and Bishops.

The most significant and interesting records are those for Grey Pratincole *Glareola cinerea*, Parasitic Jaeger *Stercorarius parasiticus*, Narina Trogon *Apaloderma narina constantia,* Rosy Bee-eater *Merops malimbicus*, Sladen's Barbet *Gymnobucco sladeni*, Red-faced Cisticola *Cisticola erythrops,* Chestnut-capped Flycatcher *Erythrocercus mccallii*, White-collared Starling *Grafisia torquata*, and Bob-tailed Weaver *Brachycope anomala*.

A Red-chested Owlet *Glaucidium tephronotum* might have been heard on one occasion, but it is also possible that what was heard was a mimic. Many bird species responded quickly and aggressively to BF's imitation of the call of the Red-chested Owlet, especially the Olive Sunbird *Cyanomitra olivacea* and Little Grey Greenbul *Andropadus gracilis*. This response strongly suggests that the Red-chested Owlet is present at Lokutu.

Notes on the More Significant and Interesting Records

Nycticorax nycticorax **Black-crowned Night-heron**. About six along Congo River emerging at dusk from riverine forest. According to Brown et al. (1982), and Sinclair and Ryan (2003), the range of this species circumvents the main forest block of the Congo Basin. This record appears to be a range extension of ca. 300 km.

Falco subbuteo **Eurasian Hobby**. One individual seen near Lokutu Airstrip in the evening. Whilst this Palearctic migrant was not a surprise, this appears to be the first record in this part of the Congo Basin.

Charadrius forbesi **Forbes's Plover**. Maximum of eight seen in open areas on and next to Lokutu Airstrip. This enigmatic intra-African migrant breeds in Sub-Sahelian West Africa and annually undertakes a south-easterly movement crossing the Congo Basin forests for western Uganda, western Tanzania and northern Zambia. The airstrip is undoubtedly a great attraction for tired migrants.

Stercorarius parasiticus **Parasitic Jaeger (Arctic Skua)**. One immature found by a local fisherman and brought to the house at Lokutu. The biggest surprise of the survey. A pelagic migrant from the Arctic that usually passes well offshore when migrating. Some, however, enter Africa and cross overland resulting in unusual records. Although virtually as far from the sea as can be attained in Africa (Lokutu is ca. 1,550 km inland from the Atlantic Ocean), this was not the first record for the region, there being one other (but no details available) (Urban et al. 1986).

Psittacus erithacus **Grey Parrot.** Singles and pairs common throughout area but no flocks encountered. Very encouraging to see this species in good numbers. Greatly threatened by the pet-trade elsewhere in its range. A few captives seen in villages.

Apaloderma narina **Narina Trogon**. Two pairs resident in forest near Lokomete. They remained very high in the canopy, unlike the species elsewhere, and showed bare yellow skin on the face instead of the usual greenish. Whilst the birds resembled *Apaloderma aequatoriale* Bare-cheeked Trogon, the call was that of Narina Trogon. It seems these

birds are referable to the West African race *constantia* (Sierra Leone to Ghana), and not the nominate race *brachyurum* as expected for this region (Fry et al. 1988, Borrow and Demey 2001). If so, this is an extension of range for *constantia* of at least 2,400 km.

Merops malimbicus **Rosy Bee-eater.** Common throughout area. Only seen in loose parties, particularly along rivers and over forest. Based on range map in Fry et al. (1988), this appears to be a slight extension of the known distribution to the east. High numbers indicate that Lokutu is well within the species' range.

Tockus camurus **Red-billed Dwarf Hornbill**. One on forest edge near Motite and three seen twice in forest near Lokomete. Abundance lower than expected. Based on range map in Fry et al. (1988), this is an extension of the known distribution by ca. 100 km up the Congo River (i.e., to the southeast).

Gymnobucco sladeni **Sladen's Barbet**. Pair near Lolobo and four near Lokomete. In clearings. On both occasions using same nest trees as Grey-throated Barbet *Gymnobucco bonapartei*. Not seen inside the forest. This Congo Basin endemic may be more abundant than these two records suggest as not much field work was conducted in forest clearings.

Smithornis rufolateralis **Rufous-sided Broadbill**. At least two territories in forest near Lokomete, but not recorded elsewhere. Less abundant than expected. Based on range map in Keith et al. (1992), this is a range extension of 50-100 km, placing the species in between the northeast and central 'populations' of *S. rufolateralis*. This suggests that birds in these localities are all part of one population (i.e., connected through the Lokutu area).

Phyllastrephus albigularis **White-throated Greenbul.** Two in dense vine tangles in forest near Lokomete. Usually a fairly common vine tangle specialist, but not in this area. On extreme western edge of the eastern population. According to the range map in Keith et al. (1992), this species not reported to the south of the Congo River in this region. Thus, this appears to be a slight extension of the range.

Nicator vireo **Yellow-throated Nicator**. One along Lokutu Airstrip and one in dense Sago Palm swamp. Not a true forest species, but an inhabitant of dense thicket and swampy areas. Density lower than expected. According to range map in Fry and Keith (2000), the distribution of this species is poorly known in the Congo Basin. These records extend the range of the northeastern population slightly to the northwest.

Saxicola rubetra **Whinchat.** Two on Lokutu Airstrip. Although apparently the first records for the Congo Basin (Keith et al. 1992), this is not a surprise for this Palearctic migrant.

Cisticola erythrops **Red-faced Cisticola**. Fairly common around Lokutu in dense scrubby and moist patches. Range map in Urban et al. (1997) does not show this species in the central Congo Basin. Lokutu records extend the range at least 250 km southwest of the nearest known population. The presence of the Red-faced Cisticola at Lokutu may be dependent upon man-made habitats.

Prinia subflava **Tawny-flanked Prinia**. Common in rank undergrowth, riverine edge, and settled areas throughout. Probably occurs naturally along major rivers, and has also entered into man-made habitats. According to range map in Urban et al. (1997) this is a range extension of ca. 100 km to the southwest.

Sylvietta denti **Lemon-bellied Crombec**. Encountered twice in forest near Lokomete. Also heard singing as part of the very weak dawn chorus. Based on the map in Urban et al. (1997), this is a new locality record among a scattering of sites for this species in the northwestern Congo Basin. Less abundant than expected.

Erythrocercus mccallii **Chestnut-capped Flycatcher**. Three pairs in forest near Lokomete. Less common than expected. According to range map in Urban et al. (1997), there are few records for this species south of the Congo River. Lokutu represents an extension of the range of the northeastern population by about 50 km south and across the Congo River.

Dryoscopus senegalensis **Red-eyed (Black-shouldered) Puffback**. One pair on edge of Lokutu Town. Less abundant than expected. This a slight extension of the known range (Fry and Keith 2000) of the northeastern population southwards across the Congo River.

Grafisia torquata **White-collared Starling**. Flock of more than 20 feeding in fruiting tree along Congo River a few kilometers up-river from Lokutu. In DRC, known only from a small area in the northeast near the Sudan border (Fry and Keith 2000). Lokutu is the first site in the Congo Basin or anywhere south of the Congo River. This is an extension of the known range of this very restricted-range species of ca. 450 km to the southwest.

Cinnyris congensis **Congo (Black-bellied Sunbird)**. One near Lokutu Airstrip. Range restricted to the Congo River and major tributaries. Lokutu is near the eastern limit of the known range.

Ploceus aurantius **Orange Weaver**. Small numbers at several places along rivers, including a male nest-building near Lokutu. Abundance as expected. A slight addition to the range for the species, but not unexpected.

Ploceus pelzelni **Slender-billed Weaver**. Fairly common around Lokutu and in riverine vegetation. Abundance as expected. Unlike in eastern Africa, the species is not strongly tied to the presence of papyrus, which is scarce along this part of the Congo River.

Ploceus nigricollis **Black-necked Weaver**. Common in open areas, secondary and scrubby growth, and riverine forest. Flocks of up to 30 seen at Lokutu. Whereas in the eastern part of its range this species is solitary or found in pairs, in the Congo Basin and in West Africa it is gregarious during the dry season (Fry and Keith 2004).

Spermophaga haematina **Western Bluebill**. About five encountered along rivers and in cultivation. In far more open situations than other *Spermophaga* spp. Extension of

range about 100 km up the Congo River (Fry and Keith 2004). Benefits from deforestation. Avoids forest. Abundance as expected.

Brachycope anomala **Bob-tailed Weaver.** Several pairs and small parties near buildings and gardens at Lokutu and Lokomete. Male building nest ca. 3 m up on outer limb of Mango tree next to occupied building. Endemic to the Congo Basin. Abundance as expected.

In addition to our RAP survey results, a preliminary list of the birds of the Lola ya Bonobo Sanctuary (near Kinshasa) is presented in Appendix 4.

DISCUSSION

Although it was predicted that the diversity of birds in and near Lokutu town would likely be high, the number of bird species found in and on the edge of Lokutu town was surprisingly low. The number of bird species encountered in the dense vegetation along flooded areas and waterways near Lokutu town was also remarkably low. A similar situation in East Africa would yield at least two-fold, perhaps three-fold, the number of bird species that we encountered in and on the edge of Lokutu town.

Expecting this to be the situation only around deforested Lokutu, on investigating the surrounding forested areas we found that they also held surprisingly low numbers of bird species, and that the forest was relatively quiet. Many species that we expected to record were either absent, or at such low densities that we failed to detect them. The rains had arrived and the birds that were present were vocalizing, so it was not a case of the species being present but silent.

During the week spent in the forest and on the forest edge, we managed to record fewer forest species than one would encounter in a single morning of birding in Semliki Forest, western Uganda, or Kakamega Forest, western Kenya.

As a whole, the lowland rainforests are reputed to have the greatest biodiversity on the African continent, but for Lokutu this is far from the case (see also the biodiversity reports on the plants, reptiles, amphibians, and mammals of the Lokutu Area). We can only speculate as to the reasons for the low avian biodiversity (and obviously low avian biomass) at Lokutu.

Greatest diversity comes with altitudinal relief, which provides the possibility for different climatic regimes, numerous microclimates and soil types, and correspondingly a complex mosaic of major and minor habitat types (i.e., niches). This, in turn, is expressed in differences in fruit, insect, predator, etc. diversity and biomass. This is why hilly or mountainous, mid-altitude (transitional), forest shows the greatest biodiversity in co-existent bird species.

The Lokutu area has little physical relief (360–410 m a.s.l.) and some species of trees and other plants have come to dominate the forests. The soils have a shallow humus layer, with the sandy substrate close to the surface. This is evidence that the soil is leached and of low fertility. Even the banks of the Congo River at Lokutu consist of compacted clay.

All of the forest streams at Lokutu have dark reddish-brown (tannin-filled) water. These toxins are not tolerated by a wide range of life forms, and presumably tannins have permeated the soil to the detriment of many species of plants and invertebrates that are important to bird diversity. Under these conditions, only a relatively small number of tolerant species of birds can persist — and few can thrive.

Our general observations of the soils and water suggest that Lokutu is a highly oligotrophic site. The paucity of nutrients in this ecosystem, coupled with a high level of tannins and perhaps other toxic compounds in the water and soil, probably accounts, in large part, for the low bird species diversity and biomass.

Many children in the area carry catapults. As such, they probably have a considerable negative impact on the larger species of birds (e.g., Turacos, Hornbills, Guineafowls and Francolins). Whilst hunters that passed us in the forest carried only Monkeys, Bates' Dwarf Antelope *Neotragus batesi* and Red River Hog *Potamochoerus porcus* (see chapter on 'Primates and Large Mammals'), none carried game birds (e.g., Guineafowls, Francolins) — nor were any game birds seen or heard during the survey. While hunting may have an impact on populations of game birds, it cannot explain the absence or near-absence of species in several taxonomic groups of birds.

Probably the most important negative influence on the number of forest-dependent species of birds at Lokutu relates to what has happened to the natural forests of the area. Not only has much forest degradation, fragmentation and loss occurred over the past ca. 85 years as a result of the establishment and operation of the oil palm plantation monoculture, much damage has also occurred to forest habitats by the many thousands of people who have been drawn to the area to work on the plantation. In meeting their requirements for food, fuel, shelter, and cash, they have converted large areas of natural forest to cropland and removed resources (e.g., bush meat, fuel wood, poles, lumber) from the natural forests — often unsustainably so. Now, with the possible closure of the oil palm plantation and the related oil palm factory, it appears inevitable that the pressure on the forests and wildlife populations of the Lokutu area, and beyond, will continue to increase and be unsustainable.

CONSERVATION RECOMMENDATIONS

Given (1) the low diversity of bird species, (2) the apparent absence of any threatened species of bird, (3) the great loss of biodiversity and other conservation values, (4) the ever increasing human population and concomitant need to exploit the area's natural resources, (5) the lack of interest/will/ability, both of central government and local government, to control and manage the use of the natural resources, and (6) the high costs (both in terms of money

and time) of working in the area, we do not find the Lokutu area to be a priority site for conservation investment or action — nor do we recommend that Lokutu be considered part of CI's Congo Basin High Biodiversity Wilderness Area. In other words, there are numerous other forests in equatorial Africa with (1) a far more valuable biodiversity, (2) fewer and lower threats, and (3) fewer constraints to effective conservation actions that should be considered before Lokutu as sites for conservation investments.

REFERENCES

Bennun, L. and K. Howell. 2002. Birds. *In:* Davies, G. (ed.). African forest biodiversity: A field survey manual for vertebrates. Earthwatch, Oxford, UK. Pp. 121–153.

Borrow, N and R. Demey. 2001. A guide to the birds of western Africa. Princeton University Press, Princeton, NJ, USA.

Demey, R. and M. Louette. 2001. Democratic Republic of Congo. *In:* Fishpool, L.D.C. and M.I. Evans (eds.). Important Bird Areas in Africa and associated islands: Priority sites for conservation. BirdLife Conservation Series No. 11. Pisces Publications, Cambridge, UK. Pp. 199–216.

Fishpool, L.D.C. and M.I. Evans (eds.). 2001. Important Bird Areas in Africa and associated islands: Priority sites for conservation. BirdLife Conservation Series No. 11. Pisces Publications, Cambridge, UK.

Fry, C.H. and S. Keith (eds.). 2000. The birds of Africa (Vol. VI). Academic Press, London, UK.

Fry, C.H. and S. Keith (eds.). 2004. The birds of Africa (Vol. VII). Princeton University Press, Princeton, NJ, USA.

Fry, C.H., S. Keith and E.K. Urban (eds.). 1988. The birds of Africa (Vol. III). Academic Press, London, UK.

IUCN. 2004. 2004 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 21 December 2005.

Keith, S., E.K. Urban and C.H. Fry (eds.). 1992. The birds of Africa (Vol. IV). Academic Press, London, UK.

Mittermeier, R.A., C.G. Mittermeier, P.R. Gil, J. Pilgrim, G. Fonseca, T. Brooks and W.R. Konstant. 2003. Wilderness. Cemex, Mexico City, Mexico.

Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca and J. Kent. 2000. Biodiversity hotspots for conservation priorities. Nature 403: 853–858.

Newing, H., G. Davies and M. Linkie. 2002. Large and medium mammals. *In:* Davies, G. (ed.). African forest biodiversity: A field survey manual for vertebrates. Earthwatch, Oxford, UK. Pp. 99–120.

Sinclair, I. and P. Ryan. 2003. Birds of Africa south of the Sahara. Struik Publishers, Cape Town, South Africa.

Urban, E.K., C.H. Fry and S. Keith (eds.). 1986. The birds of Africa (Vol. II). Academic Press, London, UK.

Urban, E.K., C.H. Fry and S. Keith (eds.). 1997. The birds of Africa (Vol. V). Academic Press, London, UK.

White, L. and A. Edwards. 2000. Conservation research in the African rain forests: A technical handbook. Wildlife Conservation Society, New York, NY, USA.

Chapter 6

A Rapid Survey of the Primates and Large Mammals of Lokutu

Thomas M. Butynski and James G. Sanderson

SUMMARY

We present the results of a survey by Conservation International's Rapid Assessment Program (RAP) of the primates and larger mammals at Lokutu, Democratic Republic of the Congo. This survey was conducted from October 26 to November 8, 2004. Visual observations, tracks, sounds, interviews with hunters, and camera phototraps were used to detect the presence of mammals. We found evidence for the presence of six species of primates and eight species of large mammals. We documented previous logging activity, ongoing wide-scale conversion of forests to oil palm plantations and gardens, and heavy hunting pressure. Hunters claimed that they never observed large mammals such as African elephants, African buffaloes, leopards, or gracile chimpanzees (bonobos). The largest mammal present is the red river hog. The primary use of the results of this survey is to identify potential areas for long-term investment as part of Conservation International's biodiversity conservation program for the Congo Basin High Biodiversity Wilderness Area. Our findings indicate that the Lokutu area is of little conservation value for the conservation of primates and large mammals due to a considerable decline in the biological richness of the site and the collapse of the primate and large mammal communities. This situation has come about as a result of forest degradation, fragmentation, and clearance, together with unsustainable levels of hunting.

INTRODUCTION

The Lokutu (formerly named 'Elizabetha') area, Democratic Republic of Congo (DRC), lies on the southern boundary of the northern-most extent of the Congo River and still contains forested areas, some of them within Unilever's Lokutu Oil Palm Plantation concession. The biodiversity contained in the forests within and surrounding Lokutu is unknown. The region south of the Congo River is known to support a rich primate diversity that includes gracile chimpanzee (or bonobo) (*Pan paniscus*), and other large mammals, such as African elephant (*Loxodonta africana*) and African buffalo (*Syncerus caffer*). Lokutu is located within the Congo Basin High Biodiversity Wilderness Area (Myers et al. 2000).

The ancestors of modern humans arose in Africa about 2 millions years ago. Hence, wildlife in Africa has evolved with, and adapted to some extent to, a highly successful bipedal predator. Unlike in the Americas, the "long coexistence of wildlife and humans in Africa has preserved this natural heritage more or less intact to the present day, particularly in the forests of Central Africa." (Mittermeier et al. 2003). Living outside the tropical forests seems to have been easier for the precursors to modern humans. As such, present human population densities continue to remain relatively low in the Congo Basin. Indeed, elephant, buffalo, bongo (*Tragelaphus euryceros*), okapi (*Okapia johnstoni*), western gorilla (*Gorilla gorilla),* eastern gorilla (*Gorilla beringei*), gracile chimpanzee, and leopard (*Panthera pardus*), the so-called intact faunal assemblages of large mammals, continue to characterize the Congo Basin High Biodiversity Wilderness Area (Mittermeier et al. 2003).

Since little is known of the biodiversity in the Lokutu area, a Rapid Assessment Program (RAP) survey of the larger mammals, primates, birds, amphibians, reptiles, dragonflies, and plants was undertaken in 2004. The objective of the RAP in Lokutu was to provide quick, efficient, reliable, and cost-effective biodiversity data on this little-known region of DRC in support of a regional conservation strategy.

METHODS

(See the Introduction and Map for information on the study sites.)

We used active and passive methods to document the presence of primates and large mammals. The active method included direct and indirect (e.g., vocalizations, tracks, nests, dung) observation of species. We made daily excursions along transects out from each camp. These excursions usually lasted 5–10 hours and involved walking at the rate of ca. 1 km/hr along footpaths, dirt tracks, forest edges, and other places we could move easily, quietly, and at a more or less constant speed. Most transects were run by one to three highly experienced observers with binoculars and (often) a tape recorder. Surveys were also carried out at night using a spotlight, binoculars and tape recorder. All evidence of the presence of primates and large mammal species was recorded during these excursions. We also collected data while in camp, such as when hunters passed through with dead mammals, and when the loud calls of primates and other species were heard. Because records were also collected opportunistically by our colleagues and by interviews with hunters, observations of some individual primates or large mammals were likely repeated.

The passive method included the use of four phototraps (PhotoScout, Highlander Sports, Huntsville, Alabama, USA; DeerCam phototrap and Vision Scouting Camera, Non-Typical Inc., Wisconsin, USA) that operated continuously at our primary survey site (Site 4 – Lukumete). These phototraps are triggered by heat-in-motion. Three phototraps used 35 mm auto-focus cameras loaded with ASA 200 print film and one phototrap used a digital camera capable of storing 20 images. Time between sensor reception and a photograph was 0.6 seconds for these units. Cameras were set to operate continuously and to wait a maximum of one minute between photographs. Cameras were placed at sites suspected of being frequented by various mammalian species and were located approximately 500 m apart and at least 200 m from camp. Camera phototraps can be used to calculate observation rates for each site just as standard transects are used. Instead of the observer making observations along a route, 'observations' move along routes in front of fixed cameras (observers). For shy and cryptic mammals under severe hunting pressure, camera trapping methods might be more effective than walking transects, especially when observers have different and varied levels of expertise.

RESULTS

We observed (either alive or dead), identified by sound, or phototrapped 14 species of large mammals in the forests of the Lokutu area (Table 6.1). Of these, six species were primates: Thomas's dwarf galago (*Galagoides thomasi*), Demidoff's dwarf galago (*G. demidovii*), yellow-nosed red-tailed monkey (*Cercopithecus ascanius whitesidei*), Congo Basin Wolf's monkey (*C. pogonias wolfi*), De Brazza's monkey (*C. neglectus*), and northern black mangabey (*Lophocebus aterrimus aterrimus*). The camera phototraps obtained 12 photographs of which five were of human hunters, two were of their dogs, and three were of an unidentified forest rat.

DISCUSSION

Primates

None of the primates whose presence we confirmed are threatened with extinction (Lee et al. 1988, http://www.redlist.org). However, primates are heavily hunted in the areas we surveyed and some species whose presence should have been confirmed (e.g., gracile chimpanzee) have probably been extirpated from the area.

Thomas's dwarf galago and Demidoff's dwarf galago: In Uganda, Equatorial Guinea, DRC, along the Albertine Rift, and elsewhere, Thomas's dwarf galago has a distinctive 'multiple crescendo' loud call and is generally found >5 m from the ground. In contrast, Demidoff's dwarf galago has a distinctive 'single crescendo' call that is longer than the first crescendo given by Thomas's dwarf galago. Demidoff's dwarf galago is usually found <5 m above the ground and, unlike Thomas's dwarf galago, prefers dense bushy vegetation (Bearder et al. 1995; Ambrose and Perkin 2000; Bearder et al. 2003; Butynski pers. obs.). During this survey, a few multiple crescendo calls were heard at Site 3 and many were heard at Site 4. Although most of the galagos giving the multiple crescendo calls were 5–25 m above the ground, some were as low as 0.5 m. Single crescendo calls were heard at Sites 2, 3 and 4, and these were emitted by galagos that were 0.5–5 m above the ground. Galago densities were low at all sites and calls were infrequently heard. This made it difficult to record the calls. However, of the several crescendo calls recorded, all were diagnosed by Dr. Simon Bearder (Nocturnal Primate Research Laboratory, Oxford Brookes University, U.K.) as belonging to *G. demidovii*. Concerning these calls Dr. Bearder wrote:

> "It seems likely that you were looking at both *G. thomasi* (high up) and *G. demidovii* (low down) but the recordings are all of *G. demidovii*. Lesley Ambrose noted that the calls of *G. demidovii* in Gabon were often heard in pairs and had a longer build-up sequence in the crescendo than in Uganda. This is the case with your recordings of crescendos."

Table 6.1. List of the larger mammals found in the Lokutu area, Democratic Republic of Congo, from 27 October to 7 November 2004. H = heard, S = seen alive, O = other. Number of observations made is given but cannot be used to determine density. No phototrap photographs of larger mammals were obtained. Scientific and vernacular names for primates are based on Grubb et al. (2003). Names for all other species are based on Kingdon (1997).

Order / Family	Species	Common Name	H	S	O
PRIMATES					
Cercopithecidae	*Cercopithecus ascanius whitesidei*	Yellow-nosed red-tailed monkey	15	17	7 dead
	Cercopithecus pogonias wolfi	Congo Basin Wolf's monkey			2 dead
	Cercopithecus neglectus	De Brazza's monkey		1	2 captives
	Lophocebus aterrimus aterrimus	Northern black mangabey			1 dead
Galagidae	*Galagoides demidovii*	Demidoff's dwarf galago	?	?	
	Galagoides thomasi	Thomas's dwarf galago	9	5	
RODENTIA					
Sciuridae	*Heliosciurus rufobrachium*	Red-legged sun squirrel		3	
	Protoxerus stangeri	African giant squirrel		2	
	Funisciurus congicus	Congo rope squirrel	8	3	
Muroidea	*Cricetomys gambianus*	Gambian or Giant-pouched rat			1 dead
CARNIVORA					
Viverridae	*Nandinia binotata*	African palm civet		1	
HYRACOIDEA					
Procavidae	*Dendrohyrax dorsalis*	Western tree hyrax	9		
ARTIODACTYLA					
Suidea	*Potamochoerus porcus*	Red river hog		1	1 dead
Bovidae	*Neotragus batesi*	Dwarf antelope			1 dead

Thus, we have no doubt that *G. demidovii* is present at low densities at Lokutu. Since there has been little attempt to document the galago fauna of the Congo Basin, this record from south of the Congo River is significant.

We are fairly certain that *G. thomasi* is also present, but this needs confirmation. *G. demidovii* and *G. thomasi* are believed to be sympatric over most of their ranges (Kingdon 1997) and their presence at Lokutu is expected. Nonetheless, if *G. thomasi* is present at Lokutu, it will be the first record (that we are aware of) for *G. thomasi* in the Congo Basin south of the Congo River (i.e., in the Cuvette Central).

Yellow-nosed red-tailed monkey (local name: maccako): This subspecies occurs widely in the Congo Basin south of the Congo River (Kingdon 1997, Gautier-Hion et al. 1999, Groves 2001). This is very likely the most common monkey present at Lokutu. A minimum of three groups were present at Site 4. Of the nine dead monkeys observed carried by hunters, six were *C. ascanius*. One captive juvenile was held by villagers near the Mosite-Lolobo junction. Being a relatively small monkey, and one that is known to persist well in degraded and secondary forest, this species has survived in spite of heavy hunting.

Congo Basin Wolf's monkey (local name: mbeka): Sometimes considered to be a full species (*C. wolfi wolfi*) (e.g., Kingdon 1997, Groves 2001) this taxon occurs over a large portion of the Congo Basin south of the Congo River (Kingdon 1997, Gautier-Hion et al. 1999, Groves 2001). Although no live *C. pogonias* were observed during this survey, two dead adult males were seen with hunters at Site 4. It is not known how far into the forest the hunters had to walk in order to find this species.

De Brazza's monkey (local name: funga): This is one of Africa's most widespread primates. One live adult male was seen (B. Finch and K.D. Dijkstra pers. obs.) near a stream at Site 3, and one captive juvenile was present near Site 4.

Northern black mangabey (local name: akombe): This is another subspecies with a wide range in the Congo Basin south of the Congo River. One dead individual was found being carried by hunters at Site 4. It is not known how far into the forest the hunters had to go to locate this species.

Species expected to be at Lokutu

The following is a list, with some notes, of those species of forest primates that are known to have wide ranges in the Congo Basin south of the Congo River (Kingdon 1997,

Gautier-Hion et al. 1999, Groves 2001) and, as such, we expected (but failed) to find them at Lokutu:

Central potto (*Perodicticus potto edwardsi*) (local name: katu): Known to occur over a wide part of the Congo Basin. Despite local knowledge of the potto we failed to encounter this species.

Allen's swamp monkey (*Allenopithecus nigroviridis*) (local name: mukundu): This species occurs on both sides of the Congo River. Hunters said that this species is present on the north side of the Congo River, but they were unaware of presence on the south side.

Sclater's Angola colobus (*Colobus angolensis angolensis*): Surprisingly, the hunters did not know this distinctive and vocal species.

Tshuapa red colobus (*Procolobus pennanti tholloni*) (local name: ekota): Hunters said that there were no red colobus in the Lokutu area.

Gracile chimpanzee or bonobo (local name: mokobosso): Hunters said that there were no *P. paniscus* in the Lokutu area, but that this species could be found to the west of the Lunua River. Hunters were aware of a second kind of chimpanzee. This must be the robust (or common) chimpanzee (*Pan troglodytes*) which occurs on the north side of the Congo River.

While the Lokutu area was expected to support up to 11 species of non-human primates (Grubb et al. 2003), we found evidence for only six species. A few of the 'missing' species may still be present at Lokutu (especially potto) at low densities or in localized sites, but it likely that at least four species have been extirpated from the Lokutu area.

Other mammals

In addition to the six species of primates, we found evidence for only eight other species of mammal in the Lokutu area (Table 6.1). Of these, four are rodents. Only one species of antelope, the dwarf antelope (*Neotragus batesi*), was confirmed (based solely on one dead individual that hunters were carrying). The largest mammal remaining in the area appears to be the red river hog (*Potamochoerus porcus*) (one individual found alive in a trap). Western tree hyrax (*Dendrohyrax dorsalis*) were heard at Sites 3 and 4, but were never observed. Hyrax also seemed to be at unusually low densities.

African elephant would certainly have inhabited the Lokutu area in the past, but there is no evidence of their presence today. Even the largest (oldest) trees do not bear the scars on their boles that result from elephant debarking, and 'elephant paths' are no longer discernible. We suspect that elephant were extirpated from the Lokutu area long ago, perhaps at the beginning of the 20th century when the oil palm plantation was being developed. Other species that must have once occurred at Lokutu include African buffalo, leopard, African golden cat (*Profelis aurata*), and several species each of duikers (*Cephalophus* spp.), genets (*Genetta* spp.), and mongooses (Herpestidae). Some of the species that we strongly suspect were once present, if not abundant, at Lokutu have been 'hunted out', while others (e.g., leopard, African golden cat) have probably been extirpated due to an inadequate prey base (another result of over-hunting by local people).

Many of the hunters at Lokutu carry 12-gauge shotguns, while others rely upon traps and dogs to catch prey. Even the game birds, such as guinea fowl (*Guttera* spp.) and francolin (*Francolinus* spp.) seem to have been impacted by these human activities as, surprisingly, no species of game bird was recorded in the Lokutu area either by us or the bird survey team (see Chapter 5).

Impact of forest loss and bushmeat hunting

Bushmeat hunting parallels habitat loss as a major threat to the survival of mammals in Africa (Bakarr et al. 2001, Rose et al. 2003). Recently, the extinction of Miss Waldron's red colobus (*Procolobus badius waldroni*) has been blamed on hunting and the demand for bushmeat (Oates 1996, Oates et al. 2000). Bushmeat is a critical protein source for many people in the region and a large number species are hunted. Antelopes, pigs, primates and large rats dominate the bushmeat trade. The extent of bushmeat hunting has prompted governments to enact hunting bans, though the legislation to date has often been impractical and/or poorly enforced (Sayer et al. 1992, Rose et al. 2003). If bushmeat hunting is not controlled, Africa's larger endemic mammalian species will be extirpated from vast areas and, possibly, driven to extinction.

Of the primates and large mammals still present at Lokutu, none are listed as threatened on the current IUCN/SSC Red List. However, two of the primates that have presumably been extirpated at Lokutu, the red colobus and the gracile chimpanzee, are listed on the 2006 Red List as Endangered (IUCN 2006).

Our findings indicate that the biologically rich community of larger mammals that is characteristic of the Congo Basin is absent at Lokutu. In addition, the few species of larger mammals that persist are present at exceedingly low densities. This collapse of the community of larger mammals at Lokutu is, no doubt, due to the interplay of at least three related factors:

(1) the large influx of people to the area over the past 100 years as a result of the presence of the oil palm plantations and the related infrastructure;

(2) widespread and extensive habitat destruction and alteration related to the conversion of natural forest to an oil palm monoculture; and

(3) long-term, widespread, intensive and unsustainable levels of hunting. This excessive hunting is now occurring far beyond the boundaries of the Lokutu Oil Palm Plantation concession.

The exploitation of the forests and wildlife of the Lokutu area has obviously been conducted at an unsustainable rate.

Now, with the possible closure of the oil palm plantation and the related oil palm factory, it appears inevitable that the pressure on the forests and wildlife populations of the Lokutu area, and beyond, will continue to increase and be unsustainable.

Our findings at Lokutu are consistent with the '*empty forest syndrome*' whereby populations of the larger mammals are reduced in density and become '*ecologically extinct*' from large areas (Redford 1992). The biologically rich community of larger mammals that must have once been present at Lokutu is now gone and will inevitably disappear over a much larger area if conversion of natural habitats and bushmeat hunting are not greatly curtailed.

REFERENCES

Ambrose, L. and A. Perkin. 2000. A survey of nocturnal prosimians at Moca on Bioko Island, Equatorial Guinea. African Primates 4: 4–10.

Bakarr, M.I., G.A.B. da Fonseca, R. Mittermeier, A.B. Rylands and K.W. Painemilla. (eds.). 2001. Hunting and Bush Meat Utilization in the African Rain Forest. Advances in Applied Biodiversity Science, Number 2, Conservation International. Washington, D.C.

Bearder, S., L. Ambrose, C. Harcourt, P. Honess, A. Perkin, E. Pimley, S. Pullen and N. Svoboda. 2003. Species-typical patterns of infant contact, sleeping site use and social cohesion among nocturnal primates in Africa. Folia Primatologica 74: 337–354.

Bearder, S.K., P.E. Honess and L. Ambrose. 1995. Species diversity among galagos with special reference to mate recognition. *In:* Alterman, L., G.A. Doyle, and M.K. Izard (eds.). Creatures of the Dark: the Nocturnal Prosimians. Plenum Publishing Co., New York. Pp. 331–352.

Gautier-Hion, A., M. Colyn and J.-P. Gautier. 1999. Histoire naturelle des primates d'Afrique Centrale. ECOFAC, Libreville, Gabon.

Groves, C.P. 2001. Primate Taxonomy. Smithsonian Institution Press, Washington, DC.

Grubb, P., T.M. Butynski, J.F. Oates, J.F., S.K. Bearder, T.R. Disotell, C.P. Groves and T.T. Struhsaker. 2003. Assessment of the diversity of African primates. International Journal of Primatology 24: 1301–1357.

IUCN 2006. 2006 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 29 October 2006.

Kingdon, J. 1997. The Kingdon Field Guide to African Mammals. Academic Press. San Diego, California.

Lee, P.J., J. Thornback and E.L. Bennett. 1988. Threatened Primates of Africa. The IUCN Red Data Book. IUCN. Gland, Switzerland and Cambridge, UK.

Mittermeier, R.A., C.G. Mittermeier, P.R. Gil, J. Pilgrim, G. Fonseca, T. Brooks and W.R. Konstant. 2003. Wilderness. Cemex, Mexico City.

Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca and J. Kent. 2000. Biodiversity hotspots for conservation priorities. Nature 403: 853–858.

Oates, J.F. 1996. African Primates: status survey and conservation action plan (revised edition). IUCN, Gland, Switzerland.

Oates, J.F., M. Abedey-Lartey, W.S. McGraw, T.T. Struhsaker and G.H. Whitesides. 2000. Extinction of a West African red colobus monkey. Conservation Biology 14: 1526–1532.

Redford, K.H. 1992. The empty forest. *BioScience* 42: 412–422.

Rose, A.L., R.A. Mittermeier, O. Langrand, O. Ampadu-Agyei, T.M. Butynski and K. Ammann. 2003. Consuming Nature: A Photo Essay on African Rain Forest Exploitation. Altisima Press, Palos Verdes, CA.

Sayer, J.A., C.S. Harcourt and N.M. Collins. 1992. The Conservation Atlas of Tropical Forests: Africa. IUCN and Simon and Schuster. Cambridge, UK.

Appendix 1

Preliminary List of Indigenous Plant Species recorded from the Lokutu Area, Basoko and Yahuma regions

W. R. Quentin Luke

	Family	Species	Specimen	Notes
	PTERIDOPHYTA			
1	?	Indet	10469	
2	?	Indet	10512	
3	?	Indet	10562	
4	Adianthaceae	*Pityrogramma calomelanos*	sr106	
5	Aspleniaceae	*Asplenium* 2	10498	
6	Aspleniaceae	*Asplenium* 3	10527	
7	Aspleniaceae	*Asplenium* 4	10572	
8	Aspleniaceae	*Asplenium holstii*	10497	
9	Cyatheaceae	*Cyathea* sp.	sr220	
10	Dryopteraceae	*Dryopteris* ?	10493	
11	Gleicheniaceae	*Dicranopteris linearis*	sr008	
12	Gleicheniaceae	*Gleichenia*	10667	
13	Hymenophyllaceae	*Hymenophyllum*	10561	
14	Lomariopsidacea	*Bolbitis* 1	10492	
15	Lomariopsidacea	*Bolbitis* 2	10513	
16	Lomariopsidacea	*Lomariopsis* 1	10524	
17	Lomariopsidacea	*Lomariopsis* 2	10525	
18	Lomariopsidacea	*Lomariopsis* 3	10526	
19	Lycopodiaceae	*Lycopodiella*	10379	
20	Oleandraceae	*Nephrolepis biserrata*	sr005	
21	Oleandraceae	*Oleandra*	sr216	
22	Polypodiaceae	*Drynaria* sp.	sr060	
23	Polypodiaceae	indet.	10696	
24	Polypodiaceae	*Microsorum punctatum*	sr087	
25	Polypodiaceae	*Phymatosorus scolopendria*	sr004	
26	Polypodiaceae	*Platycerium elephantotis*	sr059	
27	Polypodiaceae	*Platycerium* sp.	sr070	
28	Pteridaceae	*Pteris* 1	10579	
29	Pteridaceae	*Pteris* 2	10641	
30	Salviniaceae	*Salvinia* sp.	sr217	
31	Schizaceae	*Lygodium*	10378	
32	Selaginellaceae	*Selaginella*	10377	

continued

	Family	Species	Specimen	Notes
	SPERMATOPHYTA			
	GYMNOSPERMAE			
33	Gnetaceae	*Gnetum africanum*	10375	
	ANGIOSPERMAE			
	DICOTYLEDONS			
34	?	indet	10692	
35	?	indet	10697	
36	?	indet	10521	
37	?	indet	10462	
38	?	indet	10465	
39	?	indet	10553	
40	?	indet	10654	
41	?	indet	10661	
42	?	indet	10665	
43	?	indet	10571	photo - common
44	Acanthaceae	*Acanthus montanus?*	sr086	
45	Acanthaceae	*Asystasia*	10535	photo
46	Acanthaceae	*Asystasia gangetica*	sr003	
47	Acanthaceae	*Elytraria marginata?*	10478	
48	Acanthaceae	indet	10389	photo
49	Acanthaceae	indet	10431	
50	Acanthaceae	*Justicia genderussa*	sr167	
51	Acanthaceae	*Pseuderanthemum ludovicianum*	10423	photo
52	Acanthaceae	*Stenandria*	10432	photo
53	Acanthaceae	*Thomandersia congolana/laurifolia*	10353	photo
54	Acanthaceae	*Thomandersia laurifolia/congolana*	10685	
55	Acanthaceae	*Thunbergia*	10648	photo
56	Acanthaceae	*Thunbergia erecta*	sr069	
57	Aizoaceae	*Gisekia pharnacioides*	10629	
58	Amaranthaceae	*Cyathula*	10500	
59	Amaranthaceae	*Gomphrena*	sr218	
60	Amaranthaceae	*Psilotrichum*	10499	
61	Anacardiaceae	*Anthrocaryon nannanii*	10688	
62	Anacardiaceae	*Lannea welwitschii*	sr080	
63	Anacardiaceae	*Sorindeia*	10652	
64	Annonaceae	*Anonidium mannii*	10505	
65	Annonaceae	*Cleistopholis patens*	10663	photo
66	Annonaceae	*Greenwayodendron suaveolens?*	10474	
67	Annonaceae	indet	10463	
68	Annonaceae	indet	10587	
69	Annonaceae	*Monanthotaxis*	10666	
70	Annonaceae	*Monodora angolensis*	10477	photo
71	Annonaceae	*Uvariodendron*	10634	
72	Annonaceae	*Xylopia*	10586	
73	Apocynaceae	*Alstonia boonei*	10501	ID'd by JP
74	Apocynaceae	*Funtumia elastica*	sr034	

continued

	Family	Species	Specimen	Notes
75	Apocynaceae	*Landolphia*	10674	
76	Apocynaceae	*Rauvolfia*	10590	
77	Apocynaceae	*Rauvolfia*	sr042	
78	Apocynaceae	*Strophanthus eminii*	10421	photo
79	Apocynaceae	*Tabernaemontana* 1	10608	photo
80	Apocynaceae	*Tabernaemontana* 2	10690	
81	Apocynaceae (Asclepiadaceae)	*Gymnema*	10360	
82	Apocynaceae (Asclepiadaceae)	*Parquetina nigrescens*	10598	ID'd by JP
83	Apocynaceae (Asclepiadaceae)	*Tacazzea apiculata*	sr090	
84	Araliaceae	*Cussonia* sp.	sr027	
85	Araliaceae	*Polyscias fulva*	sr068	
86	Aristolochiaceae	*Aristolochia*	10612	photo
87	Asteraceae (Compositae)	*Ageratum conyzoides*	sr172	weed
88	Asteraceae (Compositae)	*Conyza bonariensis*	sr118	weed
89	Asteraceae (Compositae)	*Crassocephalum rubens*	10630	
90	Asteraceae (Compositae)	*Eclipta*	10627	
91	Asteraceae (Compositae)	*Emilia*	sr071	
92	Asteraceae (Compositae)	*Ethulia*	10628	
93	Asteraceae (Compositae)	indet	10591	
94	Asteraceae (Compositae)	indet	10656	
95	Asteraceae (Compositae)	*Melanthera*	10619	
96	Asteraceae (Compositae)	*Mikania*	10596	
97	Asteraceae (Compositae)	*Spilanthes*	sr097	
98	Balanophoraceae	*Thonningia sanguinea*	10471	photo
99	Balsaminaceae	*Impatiens* nr *niamniam*	10429	photo
100	Balsaminaceae	*Impatiens walleriana?*	10622	photo
101	Bignoniaceae	*Spathodea campanulata*	sr202	naturalised?
102	Bombaceae	*Ceiba pentandra*	sr130	
103	Boraginaceae	*Tournefortia* sp. ?	10604	
104	Burseraceae	*Canarium schweinfurthii*	sr079	
105	Burseraceae	*Dacryodes edulis*	10668	
106	Capparaceae	*Cleome* sp.	sr219	
107	Capparaceae	*Crateva*	10635	
108	Cecropiaceae	*Musanga cecropioides*	sr026	
109	Cecropiaceae	*Myrianthus arboreus*	sr028	
110	Celastraceae	*Hipp* 1	10616	
111	Celastraceae	*Hipp* 2	10670	
112	Celastraceae	*Maytenus*	10575	
113	Celastraceae	*Salacia* 1	10460	
114	Celastraceae	*Salacia* 2	10486	
115	Chrysobalanaceae	*Parinari*	10548	
116	Clusiaceae (Guttiferae)	*Garcinia huillensis?*	10490	
117	Clusiaceae (Guttiferae)	*Harungana madagascariensis*	sr055	
118	Clusiaceae (Guttiferae)	*Symphonia globulifera*	10559B	
119	Combretaceae	*Combretum* 1	10647	photo
120	Combretaceae	*Combretum* 2	10671	

continued

	Family	Species	Specimen	Notes
121	Connaraceae	*Agelaea*	10615	
122	Connaraceae	*Connarus*	10583	
123	Connaraceae	indet	10693	
124	Connaraceae	*Manotes griffoniana?*	10435	photo
125	Conneraceae	*Cnestis*	10390	photo
126	Convolvulaceae	*Hewittia malabarica*	sr020	
127	Convolvulaceae	*Ipomoea aquatica*	sr089	7th
128	Convolvulaceae	*Ipomoea cairica*	sr025	
129	Convolvulaceae	*Ipomoea involucrata*	sr001	
130	Convolvulaceae	*Ipomoea mauritiana*	sr062	
131	Convolvulaceae	*Stictocardia* sp.	sr065	pink
132	Cucurbitaceae	*Eurieandra formosa?*	10617	photo
133	Cucurbitaceae	*Momordica*	10593	
134	Cucurbitaceae	*Oreosyce?*	10611	
135	Dichapetalaceae	*Dichapetalum* 1	10370	
136	Dichapetalaceae	*Dichapetalum* 2	10372	
137	Dichapetalaceae	*Dichapetalum* 3	10541	
138	Dilleniaceae	*Tetracera*	10397	
139	Ebenaceae	*Diospyros* 1	10507	
140	Ebenaceae	*Diospyros* 2	10533	
141	Ebenaceae	*Diospyros* 3	10565	photo
142	Ebenaceae	*Diospyros* 4	10653	
143	Euphorbiaceae	*Acalypha*	10643	
144	Euphorbiaceae	*Alchornea cordifolia*	10381	
145	Euphorbiaceae	*Alchornea floribunda*	10577	
146	Euphorbiaceae	*Alchornia hirtella*	10436	
147	Euphorbiaceae	*Bridelia micrantha*	sr091	
148	Euphorbiaceae	*Bridelia* sp. 1	sr076	
149	Euphorbiaceae	*Cavcoa*	10481	
150	Euphorbiaceae	*Croton macro?*	sr064	
151	Euphorbiaceae	*Croton mega*	10532	
152	Euphorbiaceae	*Crotonogyne?*	10542	
153	Euphorbiaceae	*Cyttaranthus?*	10459	photo
154	Euphorbiaceae	*Cyttaranthus?*	10576	
155	Euphorbiaceae	*Dalechampia* sp.	sr032	
156	Euphorbiaceae	*Drypetes*	10484	
157	Euphorbiaceae	*Erythrococca* 1	10610	
158	Euphorbiaceae	*Erythrococca* 2	10644	
159	Euphorbiaceae	*Euphorbia heterophylla*	sr184	weed
160	Euphorbiaceae	*Euphorbia hirta*	sr185	
161	Euphorbiaceae	indet	10402	
162	Euphorbiaceae	indet	10415	Weed
163	Euphorbiaceae	indet	10631	
164	Euphorbiaceae	indet	10681	
165	Euphorbiaceae	*Macaranga spinosa*	sr072	
166	Euphorbiaceae	*Manniophyton*	sr082	fibre

continued

	Family	Species	Specimen	Notes
167	Euphorbiaceae	*Phyllanthus* 2	10686	
168	Euphorbiaceae	*Phyllanthus amarus*	10620	
169	Euphorbiaceae	*Ricinodendron heudelotii*	sr036	
170	Euphorbiaceae	*Sapium ellipticum*	sr098	
171	Euphorbiaceae	*Suregada procera*	10599	
172	Euphorbiaceae	*Uapaca guineensis*	10510	
173	Euphorbiaceae	*Uapaca nitida*	10657	
174	Flacourtiaceae	*Barteria nigritina*	10358	
175	Flacourtiaceae	*Buchnerodendron?*	10368	
176	Flacourtiaceae	*Calancoba glauca*	10369	
177	Flacourtiaceae	*Caloncoba welwitschii*	10476	
178	Flacourtiaceae	*Homalium africana*	10669	
179	Flacourtiaceae	indet	10675	photo
180	Flacourtiaceae	*Lindackeria*	10361	
181	Flacourtiaceae	*Rawsonia*	10701	
182	Flacourtiaceae	*Xylotheca*	10650	photo
183	Hymenocardiaceae	*Hymenocardia acida*	sr063	
184	Icacinaceae	*Alsodeiopsis?*	10408	
185	Ixonanthaceae	*Irvingia*	10605	
186	Ixonanthaceae	*Irvingia smithii*	10633	
187	Ixonanthaceae	*Klaenedoxa gabonensis*	10554	
188	Lamiaceae (Labiatae)	*Plectranthus* 1	10373	
189	Lamiaceae (Labiatae)	*Plectranthus* 2	10564	
190	Lecythidaceae	*Petersianthus macrocarpus*	10555	
191	Leguminosae (Caesalpiniaceae)	*Afzelia bipindensis*	sr083	ID'd by JP
192	Leguminosae (Caesalpiniaceae)	*Afzelia?*	10679	photo
193	Leguminosae (Caesalpiniaceae)	*Anthonotha*	10676	
194	Leguminosae (Caesalpiniaceae)	*Berlinia*	10659	photo
195	Leguminosae (Caesalpiniaceae)	*Daniellia?*	10557	
196	Leguminosae (Caesalpiniaceae)	*Gilbertiodendron dewevrei*	10430	
197	Leguminosae (Caesalpiniaceae)	*Gossweilerodendron balsamiferum*	sr113	not seen but said to occur
198	Leguminosae (Caesalpiniaceae)	*Guibourtia demeusei*	10559A	
199	Leguminosae (Caesalpiniaceae)	*Guibourtia demeusei*	10689	photo
200	Leguminosae (Caesalpiniaceae)	indet	10470	
201	Leguminosae (Caesalpiniaceae)	indet	10569	
202	Leguminosae (Caesalpiniaceae)	indet	10636	
203	Leguminosae (Caesalpiniaceae)	*Oxystigma oxyphyllum*	10556	
204	Leguminosae (Caesalpiniaceae)	*Scorodophloeos zenkeri*	10509	
205	Leguminosae (Caesalpiniaceae)	*Senna occidentalis*	sr119	
206	Leguminosae (Caesalpiniaceae)	*Tetrapleura tetraptera*	sr073	
207	Leguminosae (Mimosaceae)	*Acacia* 2	10545	
208	Leguminosae (Mimosaceae)	*Acacia farnesiana?*	10399	planted?
209	Leguminosae (Mimosaceae)	*Albizia* 1	10649	photo
210	Leguminosae (Mimosaceae)	*Albizia* 2	10700	photo
211	Leguminosae (Mimosaceae)	*Albizia glaberrima*	sr044	
212	Leguminosae (Mimosaceae)	*Albizia gummifera*	sr043	

continued

	Family	Species	Specimen	Notes
213	Leguminosae (Mimosaceae)	*Mimosa* 1	sr002	
214	Leguminosae (Mimosaceae)	*Pentaclethera macrophylla*	10664	
215	Leguminosae (Mimosaceae)	*Piptadeniastrum africanum*	sr067	
216	Leguminosae (Papilionaceae)	*Aeschenomene*	10626	
217	Leguminosae (Papilionaceae)	*Baphia* 2	10651A	
218	Leguminosae (Papilionaceae)	*Baphia?*	10485	
219	Leguminosae (Papilionaceae)	*Craibia laurentii*	10651B	photo
220	Leguminosae (Papilionaceae)	*Crotalaria* sp.	sr116	
221	Leguminosae (Papilionaceae)	*Desmodium*	10625	
222	Leguminosae (Papilionaceae)	*Desmodium triflorum*	sr112	
223	Leguminosae (Papilionaceae)	*Dioclea reflexa*	10443	
224	Leguminosae (Papilionaceae)	*Entada rheedii*	sr221	
225	Leguminosae (Papilionaceae)	indet	10376	
226	Leguminosae (Papilionaceae)	indet	10682	
227	Leguminosae (Papilionaceae)	*Indigofera* sp.	sr115	
228	Leguminosae (Papilionaceae)	*Leptoderris* sp.	sr120	
229	Leguminosae (Papilionaceae)	*Millettia laurentii*	sr077	
230	Leguminosae (Papilionaceae)	*Mucuna flagellipes*	10442	
231	Leguminosae (Papilionaceae)	*Pericopsis elata*	10496	
232	Leguminosae (Papilionaceae)	*Pterocarpus*	10584	
233	Leguminosae (Papilionaceae)	*Pterocarpus* 1	10530	
234	Leguminosae (Papilionaceae)	*Pterocarpus soy*	sr075	
235	Leguminosae (Papilionaceae)	*Pterocarpus tinct?*	10563	
236	Leguminosae (Papilionaceae)	*Teramnus*	10367	
237	Linaceae	*Hugonia*	sr054	
238	Loganiaceae	*Anthocleista*	sr049	
239	Loganiaceae	*Mostuea*	10419	
240	Loganiaceae	*Strychnos angolensis?*	sr121	
241	Loranthaceae	*Agelanthus* sp.	sr122	
242	Malvaceae	*Hibiscus*	10618	
243	Malvaceae	*Hibiscus surratensis*	sr023	
244	Malvaceae	*Sida acuta*	sr142	
245	Malvaceae	*Urena lobata*	sr018	
246	Melastomaceae	*Calvoa orientalis*	10410	
247	Melastomaceae	*Dissotis* 1	10409	
248	Melastomaceae	*Dissotis* 2	10446	
249	Melastomaceae	*Dissotis* 3	10624	photo
250	Melastomaceae	indet	10420	photo
251	Melastomaceae	indet	10540	
252	Meliaceae	*Entandrophragma utile*	10511	
253	Meliaceae	indet	10438	
254	Meliaceae	indet	10452	
255	Meliaceae	*Khaya anthotheca*	sr039	
256	Meliaceae	*Turraea cabrae*	10384	photo
257	Melianthaceae	*Bersama* sp.	sr081	
258	Menispermaceae	indet	10673	

continued

	Family	Species	Specimen	Notes
259	Menispermaceae	*Jateorhiza*	sr040	
260	Menispermaceae	*Tinospora* sp.	sr031	
261	Menispermaceae	*Triclisia*	10694	
262	Moraceae	*Antiaris toxicaria*	sr021	
263	Moraceae	*Dorstenia*	10351	
264	Moraceae	*Dorstenia kameruniana*	sr033	
265	Moraceae	*Ficus asperifolia*	sr105	
266	Moraceae	*Ficus bubu*	sr056	
267	Moraceae	*Ficus craterostoma*	10418	
268	Moraceae	*Ficus cyathistipula*	10581	
269	Moraceae	*Ficus exasperata*	sr117	Lingomo
270	Moraceae	*Ficus nigropunctata?*	10404	
271	Moraceae	*Ficus ottonifolia?*	10560	
272	Moraceae	*Ficus polita*	sr022	
273	Moraceae	*Ficus* sp. 1	10413	
274	Moraceae	*Ficus* sp. 2	10585	
275	Moraceae	*Ficus* sp. 3	10655	
276	Moraceae	*Ficus sycomorus*	sr094	
277	Moraceae	*Ficus thonningii*	sr051	
278	Moraceae	*Ficus tremula?*	10691	
279	Moraceae	*Ficus vallis-choudae*	sr104	
280	Moraceae	*Milicia excelsa*	sr024	
281	Moraceae	*Treculia africana*	sr103	
282	Moraceae	*Trilepisium madagascariensis*	sr037	
283	Myristicaceae	*Pycnanthus angolensis*	sr078	
284	Nymphaeaceae	*Nymphaea*	sr053	white
285	Ochnaceae	*Gomphia* 1	10453	
286	Ochnaceae	*Gomphia* 2	10687	photo
287	Olacaceae	*Heisteria parvifolia*	10642	photo
288	Olacaceae	*Olax gambicola*	sr029	
289	Olacaceae	*Ongokea gore*	10489	edible frts
290	Olacaceae	*Strombosia*	10447	
291	Olacaceae	*Strombosia*	10601	
292	Olacaceae	*Strombosia*	10614	
293	Olacaceae	*Strombosiopsis?*	10488	
294	Onagraceae	*Ludwigia*	10662	
295	Opiliaceae	indet	10461	
296	Oxalidaceae	*Biophytum*	10549	
297	Pandaceae	*Panda oleosa*	10479	photo
298	Passifloraceae	*Adenia gummifera*	sr041	
299	Piperaceae	*Peperomia pellucida*	sr057	
300	Piperaceae	*Peperomia rotundifolia*	10603	
301	Piperaceae	*Piper guineensis*	sr088	
302	Piperaceae	*Piper umbellatum*	sr107	
303	Rhamnaceae	indet	10695	
304	Rhamnaceae	*Maesopsis eminii*	sr038	

continued

	Family	Species	Specimen	Notes
305	Rubiaceae	*Aidia micrantha*	10364	
306	Rubiaceae	*Aoranthe*	10387	
307	Rubiaceae	*Bertiera*	10366	
308	Rubiaceae	*Bertiera* 2	10434	
309	Rubiaceae	*Chassalia*	10537	
310	Rubiaceae	*Coffea canephora*	sr169	
311	Rubiaceae	*Craterispermum schweinfurthii*	sr007	
312	Rubiaceae	*Geophila*	10426	photo
313	Rubiaceae	*Hedythyrsa*	10464	
314	Rubiaceae	*Hedythyrsa*	10573	
315	Rubiaceae	*Heinsia crinita*	10441	
316	Rubiaceae	indet	10428	photo
317	Rubiaceae	indet	10592	photo
318	Rubiaceae	indet	10613	
319	Rubiaceae	indet	10638	
320	Rubiaceae	indet	10658	photo
321	Rubiaceae	indet	10412	photo
322	Rubiaceae	*Leptactina* 1	10398	
323	Rubiaceae	*Leptactina leopold-secundi*	10433	
324	Rubiaceae	*Massularia acuminata*	10517	photo
325	Rubiaceae	*Morinda*	10371	
326	Rubiaceae	*Mussaenda*	10374	
327	Rubiaceae	*Mussaenda elegans*	10386	photo
328	Rubiaceae	*Oxyanthus* 1	10422	
329	Rubiaceae	*Oxyanthus* 2	10508	
330	Rubiaceae	*Pentas* 1	10401	
331	Rubiaceae	*Pentas* 2	10466	
332	Rubiaceae	*Pseudomussaenda stenocarpa*	10385	
333	Rubiaceae	*Psychotria* 1	10354	
334	Rubiaceae	*Psychotria* 2	10365	
335	Rubiaceae	*Psychotria* 3	10406	
336	Rubiaceae	*Psychotria* 4	10425	photo
337	Rubiaceae	*Psychotria* 5	10444	
338	Rubiaceae	*Psychotria* 6	10495	
339	Rubiaceae	*Psychotria* 7	10539	
340	Rubiaceae	*Psychotria* 8	10574	
341	Rubiaceae	*Psychotria* 9	10600	
342	Rubiaceae	*Psychotria* 10	10660	
343	Rubiaceae	*Psydrax*	sr085	
344	Rubiaceae	*Rothmannia* 2	10449	
345	Rubiaceae	*Rothmannia* 3	10472	photo
346	Rubiaceae	*Rothmannia* 4	10473	
347	Rubiaceae	*Rothmannia octomera*	10362	
348	Rubiaceae	*Rutidea*	10451	
349	Rubiaceae	*Sabicea* 1	10427	photo
350	Rubiaceae	*Sabicea* 2	10467	

continued

	Family	Species	Specimen	Notes
351	Rubiaceae	*Sarcocephalus latifolius*	sr101	
352	Rubiaceae	*Stipularia africana*	10394	
353	Rubiaceae	*Tarenna*	10392	photo
354	Rutaceae	*Citriopsis acuminata*	10567	
355	Rutaceae	*Zanthoxylum gilletii*	sr123	common
356	Rutaceae	*Zanthoxylum rubescens?*	sr109	
357	Sapindaceae	*Allophylus* sp.	sr016	
358	Sapindaceae	*Blighia* sp.	sr015	
359	Sapindaceae	*Chytranthus*	10672	
360	Sapindaceae	*Majidea?*	10568	
361	Sapindaceae	*Paulinia pinnata*	sr013	
362	Sapotaceae	*Gambeya*	10502	
363	Sapotaceae	indet	10588	
364	Scrophulariaceae	*Artanema*	10623	photo
365	Scrophulariaceae	*Lindernia*	10621	
366	Scrophulariaceae	*Torenia*	10506	
367	Solanaceae	*Physalis angulata*	sr095	
368	Solanaceae	*Solanum anguivi*	10606	
369	Solanaceae	*Solanum dasyphyllum*	sr114	
370	Solanaceae	*Solanum torvum*	10411	
371	Sterculiaceae	*Cola* 1	10363	
372	Sterculiaceae	*Cola* 1	10480	
373	Sterculiaceae	*Cola* 2	10491	
374	Sterculiaceae	*Cola* 2	10536	
375	Sterculiaceae	*Cola* 4	10580	
376	Sterculiaceae	*Cola* 5	10683	photo
377	Sterculiaceae	*Cola pachycarpa?*	10546	photo
378	Sterculiaceae	*Leptonychia*	10518	
379	Sterculiaceae	*Nesogordonia*	10645	
380	Sterculiaceae	*Sterculia*	10417	
381	Sterculiaceae	*Sterculia tragacantha*	10400	
382	Thymelaeaceae	*Dicranolepis*	10578	
383	Thymelaeaceae	*Peddaea*	10439	photo
384	Tiliaceae	*Desplatsia dewevrei*	10514	
385	Tiliaceae	*Glyphaea brevis*	10640	
386	Tiliaceae	*Triumfetta tomentosa*	sr046	
387	Ulmaceae	*Celtis mildbr*	sr084	
388	Ulmaceae	*Trema orientalis*	sr045	
389	Urticaceae	indet	10594	
390	Urticaceae	*Lapourtea*	10396	
391	Urticaceae	*Pilea microphylla*	sr058	
392	Urticaceae	*Urera hyps*	10391	
393	Urticaceae	*Urera trinervis*	10475	
394	Verbenaceae	*Clerodendrum* 1	10393	photo
395	Verbenaceae	*Clerodendrum* 2	10405	photo
396	Verbenaceae	*Clerodendrum* 3	10414	photo

continued

	Family	Species	Specimen	Notes
397	Verbenaceae	*Clerodendrum* 4	10544	photo
398	Verbenaceae	*Clerodendrum splendens?*	10445	photo
399	Verbenaceae	*Clerodenrum thomsonii*	sr222	
400	Verbenaceae	*Hoslundia opposita*	sr017	
401	Verbenaceae	*Stachytarpheta urticifolia*	sr151	
402	Violaceae	*Rinorea* 1	10504	
403	Violaceae	*Rinorea* 2	10519	
404	Vitaceae	*Cayratia trifol*	sr100	
405	Vitaceae	*Cissus* 1	10380	
406	Vitaceae	*Cissus* 2	10407	
407	Vitaceae	*Cissus* 3	10458	
408	Vitaceae	*Cissus* 4	10494	
409	Vitaceae	*Cissus* 5	10538	
410	Vitaceae	*Cyphostemma adenocaule*	sr014	
411	Vitaceae	*Leea guineensis*	sr009	
	MONOCOTYLEDONS			
412	Amaryllidaceae	*Gloriosa superba*	sr099	yellow 6th
413	Araceae	*Anchomanes abbreviata*	sr052	
414	Araceae	*Culcasia*	10602	
415	Araceae	indet	10395	
416	Araceae	indet	10482	
417	Araceae	indet	10523	
418	Araceae	indet	10632	
419	Araceae	*Stylochiton*	10483	
420	Arecaceae (Palmae)	*Elais guineensis*	sr124	
421	Arecaceae (Palmae)	indet	10558	
422	Arecaceae (Palmae)	*Raffia*	sr050	
423	Arecaceae (Palmae)	rattan 1	sr074	
424	Arecaceae (Palmae)	rattan 2	10448	
425	Arecaceae (Palmae)	rattan 3	10637	
426	Asparagaceae	*Asparagus* sp.	sr030	
427	Commelinaceae	indet	10534	
428	Commelinaceae	*Aneilema*	10383	photo
429	Commelinaceae	*Commelina*	10352	photo
430	Commelinaceae	*Palisota*	10357	
431	Commelinaceae	*Pollia*	10359	
432	Commelinaceae	*Pollia*	10416	
433	Commelinaceae	*Pollia*	10456	
434	Commelinaceae	*Pollia*	10515	
435	Commelinaceae	*Pollia*	10551	
436	Commelinaceae	*Pollia condensata*	10457	
437	Commelinaceae	*Stapfiella* 1	10382	
438	Commelinaceae	*Stapfiella* 2	10424	photo
439	Cyperaceae	*Cyperus papyrus*	sr093	
440	Cyperaceae	*Hypolytrum*	10680	
441	Cyperaceae	*Scleria boivini*	sr010	

continued

	Family	Species	Specimen	Notes
442	Cyperaceae	*Scleria racemosa*	sr066	
443	Dioscoreaceae	*Dioscorea* 1	10597	
444	Dioscoreaceae	*Dioscorea* 2	10609	
445	Dracaenaceae	*Dracaena* 2	10520	
446	Dracaenaceae	*Dracaena* 3	10547	
447	Dracaenaceae	*Dracaena arborea*	sr156	
448	Dracaenaceae	*Dracaena camerooniana*	10503	
449	Dracaenaceae	*Dracaena fragrans*	sr110	
450	Dracaenaceae	*Dracaena manni*	sr061	
451	Iridaceae	indet	10355	
452	Marantaceae	*Ataenidia conferta?*	10522	
453	Marantaceae	*Marantochloa* 1	10468	
454	Marantaceae	*Marantochloa* 2	10543	
455	Marantaceae	*Marantochloa* 3	10639	photo
456	Marantaceae	*Megaphrynium macrostachyum*	10450	
457	Marantaceae	*Trachyphrynium*	10388	
458	Orchidaceae	*Ancistorhynchus* sp.	10566	
459	Orchidaceae	*Angraecum/Solenangis* sp.	10455	
460	Orchidaceae	*Bulbophyllum* 1	10698	
461	Orchidaceae	*Bulbophyllum* 2	10699	
462	Orchidaceae	*Calyptrochilum christianum*	10678	
463	Orchidaceae	*Corymborkis corymbis*	10559C	
464	Orchidaceae	*Diaphananthe*	10487	
465	Orchidaceae	*Diaphananthe* 2	10677	photo
466	Orchidaceae	indet	10570	photo
467	Orchidaceae	*Manniella gustavi*	10589	photo
468	Orchidaceae	*Polystachya tesselata*	10454	
469	Pandanaceae	*Pandanus*	sr111	
470	Poaceae (Graminae)	indet	10528	
471	Poaceae (Graminae)	indet	10646	
472	Poaceae (Graminae)	*Leptastis* sp.	10529	
473	Poaceae (Graminae)	*Olyra latifolia*	sr035	
474	Poaceae (Graminae)	*Oplismenus*	10595	
475	Poaceae (Graminae)	*Panicum*	10550	
476	Poaceae (Graminae)	*Panicum maximum*	sr011	
477	Poaceae (Graminae)	*Phragmites*	10684	
478	Poaceae (Graminae)	*Setaria megaphylla*	sr012	
479	Smilacaceae	*Smilax*	sr047	
480	Zingerberaceae	*Aframomum* 1	10356	photo
481	Zingerberaceae	*Aframomum* 2	10516	
482	Zingerberaceae	*Aframomum* 3	10552	
483	Zingerberaceae	*Costus*	10437	photo
484	Zingerberaceae	*Costus*	sr006	photo
485	Zingerberaceae	*Renealmia*	10531	

Appendix 2

List of Plant Species thought to be introduced (exotic, crops, naturalised or weed)

W. R. Quentin Luke

	Family	Species	Common Name	Status
	GYMNOSPERMAE			
1	Cupressaceae	*Cupressus* sp.		exotic
2	Cycadaceae	*Cycas revoluta*		exotic
	ANGIOSPERMAE			
	DICOTYLEDONS			
3	?	*?*	Candle Tree	exotic
4	Acanthaceae	*Odontonema strictum*		exotic
5	Acanthaceae	*Thunbergia grandiflora f.alba*		exotic
6	Amaranthaceae	*Amaranthus* sp.	Amaranth	crop
7	Anacardiaceae	*Magnifera indica*	Mango	exotic
8	Anacardiaceae	*Spondias mombin*		exotic
9	Annonaceae	*Annona muricata*	Soursop	exotic
10	Annonaceae	*Cananga odorata*	Ylang-ylang	exotic
11	Apocynaceae	*Allamanda cathartica*	Yellow Allamanda	exotic
12	Apocynaceae	*Catharanthus roseus*	Madagascar Periwinkle	naturalised
13	Apocynaceae	*Plumeria alba*	White Frangipani	exotic
14	Apocynaceae	*Plumeria rubra*	Pink Frangipani	exotic
15	Asteraceae (Compositae)	*Tithonia diversifolia*		naturalised
16	Asteraceae (Compositae)	*Zinnia* sp.		exotic
17	Bignoniaceae	*Macfadyena* sp.		exotic
18	Bixaceae	*Bixa orellana*	Bixa	crop
19	Caricaceae	*Carica papaya*	Pawpaw	crop
20	Combretaceae	*Terminalia catappa*	Bastard Almond	planted
21	Convolvulaceae	*Ipomoea alba*		naturalised
22	Convolvulaceae	*Ipomoea batatas*	Sweet Potato	crop
23	Convolvulaceae	*Ipomoea carnea* ssp. *fistulosa*		exotic
24	Convolvulaceae	*Ipomoea purpurea*	Morning Glory	exotic
25	Cucurbitaceae	*Cucurbita* sp.	Pumpkin	crop
26	Cucurbitaceae	*Lagenaria siceraria*	Bottle gourd	crop
27	Cucurbitaceae	*Luffa cylindrica*	Luffa	naturalised
28	Euphorbiaceae	*Breynia disticha* var. *disticha f.nivosa*		exotic
29	Euphorbiaceae	*Codiaeum variegatum*		exotic
30	Euphorbiaceae	*Euphorbia cotinifolia*		exotic
31	Euphorbiaceae	*Hevea braziliensis*	Rubber	exotic

continued

	Family	Species	Common Name	Status
32	Euphorbiaceae	*Jatropha curcas*	Physic Nut	exotic
33	Euphorbiaceae	*Manihot esculenta*	Casava	crop
34	Euphorbiaceae	*Manihot glaziovii*		exotic
35	Lauraceae	*Persea americana*	Avocado	crop
36	Leguminosae (Caesalpiniaceae)	*Bauhinia tomentosa*		planted
37	Leguminosae (Caesalpiniaceae)	*Caesalpinia pulcherrima*		exotic
38	Leguminosae (Caesalpiniaceae)	*Delonix regia*	Flamboyant	exotic
39	Leguminosae (Caesalpiniaceae)	*Senna alata*		exotic
40	Leguminosae (Caesalpiniaceae)	*Senna siamea*		exotic
41	Leguminosae (Caesalpiniaceae)	*Senna spectabilis*		exotic
42	Leguminosae (Mimosaceae)	*Acacia* sp. 2		exotic
43	Leguminosae (Mimosaceae)	*Acacia* sp. 1		exotic
44	Leguminosae (Mimosaceae)	*Calliandra surinamensis*		exotic
45	Leguminosae (Papilionaceae)	*Centrosema pubescens*		naturalised
46	Leguminosae (Papilionaceae)	*Gliricidia sepium*		exotic
47	Malvaceae	*Abelmoschus esculentus*	Okra	crop
48	Malvaceae	*Hibiscus rosa-sinensis*		exotic
49	Malvaceae	*Hibiscus schizopetalus*		planted
50	Melastomaceae	*Bellucia axinanthera*		naturalised
51	Moraceae	*Artocarpus altilis*	Breadfruit	exotic
52	Moraceae	*Artocarpus heterophyllus*	Jackfruit	exotic
53	Moraceae	*Morus alba*	Mulberry	exotic
54	Myrtaceae	*Psidium guajava*	Guava	naturalised
55	Myrtaceae	*Syzygium malaccensis*	Malay Apple	exotic
56	Nyctaginaceae	*Bougainvillea* sp.		exotic
57	Oxalidaceae	*Averrhoa carambola*	Carambola	exotic
58	Passifloraceae	*Passiflora edulis f. flavicarpa*	Maracuja passionfruit	crop
59	Passifloraceae	*Passiflora foetida*		naturalised
60	Polygonaceae	*Antigonon leptopus*	Coral creeper	exotic
61	Proteaceae	*Grevillea robusta*	Grevillea	exotic
62	Rosaceae	*Rosa* sp.	Rose	exotic
63	Rutaceae	*Citrus limon*	Lemon	exotic
64	Solanaceae	*Capsicum frutescens*	Chili	naturalised
65	Solanaceae	*Lycopersicon esculentum*	Tomato	crop
66	Solanaceae	*Solanum melongena*	Aubergine	crop
67	Solanaceae	*Solanum wrightii*	Potato Tree	exotic
68	Sterculiaceae	*Theobroma cacao*	Cocoa	crop
69	Verbenaceae	*Lantana camara*		naturalised
	MONOCOTYLEDONS			
70	Alliaceae	*Allium cepa*	Onion	crop
71	Araceae	*Colocasia* sp.	Cocoyam	crop
72	Araceae	*Dieffenbachia maculata*		exotic
73	Arecaceae (Palmae)	*Cocos nucifera*	Coconut	crop
74	Bromeliaceae	*Ananas comosus*	Pineapple	crop
75	Cannaceae	*Canna indica*		naturalised
76	Cannaceae	*Canna* sp.		exotic
77	Dioscoreaceae	*Dioscorea alata*	Yam	planted
78	Dracaenaceae	*Agave americana*	Ornamental Sisal	exotic

continued

	Family	Species	Common Name	Status
79	Dracaenaceae	*Sansevieria* sp.		planted
80	Musaceae	*Musa* sp.	Banana	crop
81	Poaceae (Graminae)	*Bambusa* sp.	Green Bamboo	planted
82	Poaceae (Graminae)	*Bambusa vulgaris*	Yellow Bamboo	planted
83	Poaceae (Graminae)	*Cymbopogon citratus*	Lemon Grass	planted
84	Poaceae (Graminae)	*Oryza* sp.	Rice	crop
85	Poaceae (Graminae)	*Pennisetum purpureum*	Elephant grass	naturalised
86	Poaceae (Graminae)	*Saccharum officinarum*	Sugar Cane	planted
87	Poaceae (Graminae)	*Sorghum* sp.	Sorghum millet	crop
88	Poaceae (Graminae)	*Zea mays*	Maize	crop
89	Strelitziaceae	*Ravenala madagascariensis*	Travellers' Palm	exotic

Appendix 3

Annotated List of Bird Species in the Lokutu Area, DRC (2004)

Brian Finch, Thomas M. Butynski and Klaas-Douwe B. Dijkstra

List follows order and taxonomy of Sinclair and Ryan (2003) *Birds of Africa South of the Sahara*. If the given name differs from that source, the Sinclair and Ryan name is given in brackets.

Species	Common name	Abundance	Palearctic migrant	Notes
PHALACROCORACIDAE				
Phalacrocorax africanus	Reed (Long-tailed) Cormorant	L		Two singles and party of five along Congo River.
ARDEIDAE				
Ardea cinerea	Grey Heron	L		Four singles and a group of three along Congo River.
Ardea melanocephala	Black-headed Heron	L		Three singles in open areas.
Ardea purpurea	Purple Heron	L		Two singles and a group of three along Congo River.
Egretta alba	Great White Egret	FL		One over Lokutu Airstrip.
Egretta garzetta	Little Egret	FL		Two singles along Congo River.
Bubulcus ibis	Cattle Egret	H		Common around Lokutu. Several flocks of >100 birds flying along Congo River. Although there are now no cattle in the area (there used to be over 15,000), the species remains common.
Ardeola rallioides	Squacco Heron	E		About five singles along Congo River and a flock of 15.
Butorides striatus	Green-backed (Striated) Heron	FL		Two singles along Congo River.
Nycticorax nycticorax	Black-crowned Night Heron	P		About six along Congo River emerging at dusk from riverine forest. According to Brown et al. (1982), and Sinclair and Ryan (2003), the range of this species circumvents the main forest block of the Congo Basin. This record appears to be a range extension of ca. 300 km.
THRESKIORNITHIDAE				
Bostrychia hagadesh	Hadeda Ibis	L		One pair in secondary growth near Lolobo.
Bostrychia rara	Spot-breasted Ibis	L		Heard (flying) at dusk on one of four evenings at camp near Lokomete.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
CICONIIDAE				
Mycteria ibis	Yellow-billed Stork	L		One along Congo River. The one bird may be a wanderer. The forests may be a barrier for this species.
Anastomus lamelligerus	African Openbill (Open-billed Stork)	E		Three singles along Congo River.
ANATIDAE				
Pteronetta hartlaubii	Hartlaub's Duck	FL		Three separate pairs on Congo River at dusk, and one pair over Lokutu one morning.
PANDIONIDAE				
Pandion haliaetus	Osprey	E	PM	One along Congo River. Either on passage or northern winter resident.
ACCIPITRIDAE				
Elanus caeruleus	Black-shouldered Kite	L		One over secondary forest ca. 12 km west of Lokutu.
Milvus migrans	Black Kite	H		Resident race *parasitus.*
Gypohierax angolensis	Palm-nut Vulture	E		Fairly common in the area, particularly along Congo River. Likely benefits from the oil palms in the plantation, in the forest, and on the swamp edge.
Polyboroides typus	African Harrier Hawk (Gymnogene)	E		Frequently encountered throughout disturbed areas.
Kaupifalco monogrammicus	Lizard Buzzard	E		Small numbers resident in clearings around Lokutu.
Aviceda cuculoides	African Cuckoo Hawk	E		One over secondary forest near Mosite.
Urotiorchis macrourus	Long-tailed Hawk	E		One over secondary forest ca. 12 km west of Lokutu.
Lophaetus occipitalis	Long-crested Eagle	E		One along Congo River.
Stephanoaetus coronatus	Crowned Eagle	L		Single individuals seen on 2 days displaying over forest near Lokomete.
FALCONIDAE				
Falco subbuteo	Eurasian Hobby	E	PM	One near Lokutu Airstrip. While the presence of this species was not a surprise, this appears to be the first record in this part of the Congo Basin.
Falco peregrinus	Peregrine Falcon	E	PM	One along Congo River.
RALLIDAE				
Sarothrura pulchra	White-spotted Flufftail	L		Single birds heard throughout the area wherever there are forest streams or very densely vegetated swamps.
Sarothrura elegans	Buff-spotted Flufftail	D		One pair calling at night near Lolobo.
JACANIDAE				
Actophilornis africanus	African Jacana	L		Two on open swampy island in Congo River opposite Lokutu.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
GLAREOLIDAE				
Glareola cinerea	Grey Pratincole	E		One on gravel island in Congo River opposite Lokutu. Mainly a western species but wanders eastwards along the major rivers of the Congo River system. According to Urban et al. (1986), Lokutu near eastern limit of species' range.
CHARADRIIDAE				
Charadrius forbesi	Forbes's Plover	E		Maximum of eight on open areas on and next to Lokutu Airstrip. Intra-African migrant. This enigmatic species breeds in Sub-Sahelian West Africa and annually undertakes a south-easterly movement crossing the Congo Basin forests for western Uganda (few records), western Tanzania (few records) and northern Zambia. The Airstrip is undoubtedly a great attraction for the tired migrants.
Vanellus albiceps	White-headed (White-crowned) Lapwing (Plover)	E		Flock of five on gravel island in Congo River opposite Lokutu. Close to the eastern edge of the range of the western population.
SCOLOPACIDAE				
Gallinago gallinago	Common Snipe	E	PM	Up to six around Lokutu Airstrip and one on gravel island in Congo River opposite Lokutu. Waders from the Northern Hemisphere heading south across the Congo Basin forest must see the airstrip as an oasis in otherwise unsuitable habitat.
Tringa nebularia	Common Greenshank	FL	PM	One on gravel island in Congo River opposite Lokutu.
Philomachus pugnax	Ruff	E	PM	Group of three on Lokutu Airstrip.
Tringa ochropus	Green Sandpiper	E	PM	One in swampy area near Lokomete, and eight on gravel island in Congo River opposite Lokutu.
Tringa glareola	Wood Sandpiper	L	PM	Up to six on Lokutu Airstrip, singles elsewhere apart from 12 on gravel island in Congo River opposite Lokutu.
Actitis hypoleucos	Common Sandpiper	E	PM	Small numbers along Congo River, but 20 on gravel island in Congo River opposite Lokutu.
Calidris minuta	Little Stint	FL	PM	One on edge of Congo River at Lokomete.
STERCORARIIDAE				
Stercorarius parasiticus	Parasitic Jaeger (Arctic Skua)		PM	One immature found by a local fisherman and brought to the house at Lokutu. The biggest surprise of the survey. A pelagic migrant from the Arctic that usually passes well off-shore when migrating. Some, however, enter Africa and cross overland resulting in unusual records. Although virtually as far from the sea as can be attained in Africa (Lokutu is ca. 1,550 km inland from the Atlantic Ocean), this was not the first record for the region, there being one other (but no details available) (Urban et al. 1986).
RHYNCHOPIDAE				
Rynchops flavirostris	African skimmer	L		One flock of five on Congo River.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
COLUMBIDAE				
Columba livia	Rock Dove (Feral Pigeon)	E		In Lokutu town.
Columba unicincta	Afep Pigeon	FL		Two or three in forest near Lokomete. Possibly hunted by people in this area.
Columba iriditorques	Western Bronze-naped Pigeon	E		Individuals scattered and calling throughout forested areas.
Streptopelia semitorquata	Red-eyed Dove	E		Common throughout area.
Treron calva	African Green Pigeon	E		Fairly common and encountered throughout area.
Turtur tympanistra	Tambourine Dove	L		Small numbers in heavily forested areas.
Turtur afer	Blue-spotted Wood-Dove	E		Common in secondary and disturbed forest throughout area.
PSITTACIDAE				
Psittacus erithacus	Grey Parrot	E		Common throughout area but no flocks encountered. Very encouraging to see this species in good numbers. Greatly threatened by the pet-trade elsewhere in its range. A few captives in villages.
MUSOPHAGIDAE				
Corythaeola cristata	Great Blue Turaco	E		Common throughout area both in forest and in heavily disturbed habitats. Often a heavily hunted species, but evidently not in this area.
Tauraco schuettii	Black-billed Turaco	L		Common in heavily forested areas but appears intolerant of disturbed situations.
CUCULIDAE				
Chrysococcyx caprius	Diderik Cuckoo	H		Fairly common throughout disturbed situations and forest edge, including clearings within forest. Surprising that this savannah species does well in this area.
Chrysococcyx klaas	Klaas's Cuckoo	L		Fairly common in open situations and on forest edge.
Chrysococcyx cupreus	African Emerald Cuckoo	E		Common in thick forest and secondary growth.
Clamator levaillantii	Levaillant's (African striped) Cuckoo	L		One near Lokutu Oil Palm Factory.
Cuculus solitarius	Red-chested Cuckoo	FL		One resident around camp near Lokomete.
Cuculus clamosus	Black Cuckoo	FL		One near Lokutu and one resident near camp at Lokomete.
Centropus sengalensis	Senegal Coucal	E		Common around Lokutu in heavily disturbed areas and in dense scrubby growth along Congo River. A few also in open areas away from major settlement. Presumably entered the area along the rivers. A species that has benefited from clearance of forest.
Ceuthmochares aureus	Blue Malkoha (Coucal/ Yellowbill)	E		Common throughout heavily forested areas and secondary growth.
STRIGIDAE				
Strix woodfordi	African Wood Owl	E		Common forest species heard during all nights away from Lokutu. Only forest owl encountered.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
Scotopelia peli	Pel's Fishing Owl	P		One at gravel island in Congo River opposite Lokutu.
APODIDAE				
Cypsiurus parvus	African Palm Swift	E		Small numbers around Lokutu and satellite settlements. Open-country species present due to clearance of forest and palm oil plantations.
Apus affinis	Little Swift	E		Small population in Lokutu, and a few at Mosite. Usually commensal with man and his structures.
Apus apus	Common (Eurasian) Swift	E	PM	Flocks of many thousands over forest and open areas.
Telecanthura ussheri	Mottled Spinetail	E		Common in Lokutu along Congo River and apparently nesting in water tower at Mosite. Not a forest species but present due to forest clearance and man-made structures.
Rhapidura sabini	Sabine's Spinetail	FL		Three over garden clearing in forest near Lokomete.
TROGONIDAE				
Apaloderma narina	Narina Trogon	L		Two pairs resident in forest near Lokomete. They remained very high in the canopy, unlike the species elsewhere, and showed bare yellow skin on the face instead of the usual bluish. Whilst the birds resembled Bare-cheeked Trogon (*Apaloderma aequatoriale*), the call was that of Narina Trogon. It seems these birds are referable to the West African race *constantia* (Sierra Leone to Ghana), and not the nominate race as expected for this region. If so, this is an extension of range for *constantia* of at least 2,400 km.
ALCEDINIDAE				
Alcedo quadribrachys	Shining-blue Kingfisher	E		Three on forested streams, and one at Lokutu Airstrip. This fairly secretive forest stream kingfisher is tolerant of disturbance and can exist in fairly open areas provided there are patches of stream deep in the shade.
Alcedo cristata	Malachite Kingfisher	E		Fairly common along Congo River, but not encountered away from Congo River.
Alcedo leucogaster	White-bellied Kingfisher	E		Two on different streams near Lokomete.
Ispidina picta	African Pygmy Kingfisher	H		Common at Lokutu and found in many other open scrub and secondary forest sites.
Ispidina leucontei	African Dwarf Kingfisher	L		One leaving nest hole near Lolobo, and another in forest near Lokomete.
Halcyon badia	Chocolate-backed Kingfisher	FL		Two in forest near Lokomete.
Halcyon malimbica	Blue-breasted Kingfisher	FL		Two in forest near Lokomete, and a displaying pair near gravel island in Congo River opposite Lokutu.
Halcyon senegalensis	Woodland Kingfisher	E		Common around Lokutu and a few in open areas near satellite settlements. Woodland and savannah species that is present due to clearance of forest.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
Ceryle rudis	Pied Kingfisher	FL		Small numbers on Congo River.
CORACIIDAE				
Eurystomus glaucurus	Broad-billed Roller	L		Only two encountered, one near Lokutu and one near Mosite.
Eurystomus gularis	Blue-throated Roller	FL		Two on edge of forest clearings near Lokomete.
MEROPIDAE				
Merops malimbicus	Rosy Bee-eater	E		Common throughout area. Only seen in loose parties, particularly along rivers and over forest. Based on range map in Fry et al. (1988), this appears to be a slight extension of the known distribution to the east. High numbers indicate that this is well within the species' range.
Merops variegatus	Blue-breasted Bee-eater	L		Singles and pairs in clearings and along rivers. One flock of 12 at Lokutu Airstrip.
BUCEROTIDAE				
Tockus camurus	Red-billed Dwarf Hornbill	L		One on forest edge near Mosite and three seen twice in forest near Lokomete. Based on range map in Fry et al (1988), this is an extension of the known distribution by ca. 100 km up the Congo River (i.e., to the southeast).
Tockus fasciatus	African Pied Hornbill	H		Surprisingly numerous throughout the area both in the forest and heavily disturbed areas.
Tropicranus albocristatus	White-crested Hornbill	E		Singles and pairs seen and heard more than a dozen times in forest near Lokomete. As usual, strongly associated with monkeys when found. Absence from other sites probably related to the very low densities (or extirpation of) monkeys from those sites as a result of heavy hunting by villagers.
Ceratogymna atrata	Black-casqued Wattled Hornbill	L		Low numbers in thick forest.
Bycanistes fistulator	Piping (White-tailed) Hornbill	E		Common in forested areas, and edges of plantations and riverine areas.
Bycanistes albotibialis	White-thighed Hornbill	L		Fairly common in thick forest and seen crossing clearings.
CAPITONIDAE				
Gymnobucco bonapartei	Grey-throated Barbet	E		Common in small colonies in dead trees in forest clearings.
Gymnobucco sladeni	Sladen's Barbet	L		Pair near Lolobo and four near Lokomete. In clearings. On both occasions using same nest trees as Grey-throated Barbet (*Gymnobucco bonapartei*). Not seen in forest. This Congo Basin endemic may be more abundant than these two these records suggest as not much field work was conducted in forest clearings.
Pogonolius scolopaceus	Speckled Tinkerbird	E		Common throughout.
Pogonolius bilineatus	Yellow-rumped Tinkerbird	L		Small numbers in forested areas.
Pogonolius subsulphureus	Yellow-throated Tinkerbird	L		Common in forest and fairly common in heavily disturbed areas.
Pogonolius atroflavus	Red-rumped Tinkerbird	L		One low down on edge of forest clearing near Lokomete.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
Tricholaema flavipunctata	Streaky-throated Barbet	E		Fairly common in heavily forested areas. Lokutu birds have black and white streaked throats and, therefore, are assigned to the eastern subspecies *T. f. ansorgei* (Fry et al. 1988, Sinclair and Ryan 2003).
Buccanodon duchaillui	Yellow-spotted Barbet	FL		Single birds seen three times in thick forest.
Trachyphonus purpuratus	Yellow-billed Barbet	L		Common in forested habitats throughout.
INDICATORIDAE				
Indicator conirostris	Thick-billed Honeyguide	FL		Two encountered, one in open at Lokutu, the second in forest near Lokomete.
PICIDAE				
Dendropicos xanthologus	Yellow-crested (Golden-crowned) Woodpecker	FL		Single birds seen twice in forest near Lokomete.
Campethera nivosa	Buff-spotted Woodpecker	FL		One in forest near Lokomete.
EURYLAIMIDAE				
Smithornis rufolateralis	Rufous-sided Broadbill	L		At least two territories in forest near Lokomete, but not recorded elsewhere. Based on range map in Keith et al. (1992), this is a range extension of 50-100 km, placing the species in between the northeast and central 'populations' of *S. rufolateralis*. This suggests that birds in these localities are all part of one population (i.e., connected through the Lokutu area).
HIRUNDINIDAE				
Riparia riparia	Sand Martin (Bank Swallow)	FL	PM	Several seen with Barn Swallows (*Hirundo rustica*) around Lokutu and Lokomete.
Psalidoprocne nitens	Square-tailed Saw-wing	L		A few singletons around Lokutu. While to the east this species is common on forest edge and in clearings, in this area it may suffer from competition with Black Saw-wing (*Psaldiprocne pristoptera).*
Psalidoprocne pristoptera	Black Saw-wing	H		Common around Lokutu, and in open areas elsewhere. Up to 15 together on Lokutu Airstrip. In eastern Kivu this species generally gives way to Square-tailed Saw-wing (*Psaldiprocne nitens*) and remains at higher elevations. At Lokutu, however, it is the more common of the two species.
Hirundo rustica	Barn (European) Swallow	E	PM	Very numerous in open areas throughout.
Hirundo abyssinica	Lesser Striped Swallow	E		A few around Lokutu. An open country swallow that has been able to colonise the area as a result of forest clearance.
Hirundo nigrita	White-throated Blue Swallow	L		One pair regularly perching on top of a tall emergent dead tree near Mosite.
Hirundo semirufa	Red-breasted Swallow	H		A few at Lokutu with juveniles, and a pair along a stream in forest near Mosite.
Hirundo senegalensis	Mosque Swallow	L		One near Lokutu Oil Palm Factory.
MOTACILLIDAE				
Motacilla aguimp	African Pied Wagtail	E		Fairly common in Lokutu and satellite settlements. Commensal with man-made habitats.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
Motacilla flava	Yellow Wagtail	E	PM	Common at Lokutu, particularly on the Airstrip. A few elsewhere in area. No adult males seen so no racial determination made.
DICRURIDAE				
Dicrurus coracinus	Velvet-mantled Drongo	L		One near Lolobo in village compound, and a pair in forest near Lokomete.
Dicrurus atripennis	Shining Drongo	L		Single birds seen twice in small mixed-species parties in forest near Lokomete.
CORVIDAE				
Corvus alba	Pied Crow	E		Abundant at Lokutu, and at all open areas and satellite settlements.
TIMALIIDAE				
Illadopsis rufipennis	Pale-breasted Illadopsis	FL		Widespread in forest areas, but nowhere numerous.
PYCNONOTIDAE				
Pycnonotus tricolor	Dark-capped (Black-eyed) Bulbul	E		Abundant around Lokutu, and common around satellite settlements and forest clearings. Not a forest species. Has greatly benefited from man-made habitats.
Phyllastrephus albigularis	White-throated Greenbul	L		Two in dense vine tangles in forest near Lokomete. A vine tangle specialist that is fairly common at some sites---but not at Lokutu. On extreme western edge of the eastern population. According to the range map in Keith et al. (1992), this species not reported south of the Congo River in this region. Thus, this appears to be a slight extension of the range.
Phyllastrephus xavieri	Xavier's Greenbul	L		Small numbers in forest near Lokomete, not encountered elsewhere. Usually one of the most numerous under-canopy greenbuls, but in very low densities here on western edge of range of eastern population.
Andropadus latirostris	Yellow-whiskered Greenbul	FL		Three in forest near Lokomete.
Andropadus virens	Little Greenbul	H		Abundant on forest edge, in riverine forest, secondary growth and scrub throughout area. Enters forest along rivers and clearings.
Andropadus gracilis	Little Grey Greenbul	L		Fairly common in lower and upper canopy of forest near Lokomete. A secretive canopy species that responded readily to Red-chested Owlet (*Glaucidium tephronotum*) imitations.
Andropadus gracilirostris	Slender-billed Greenbul	L		Widespread in forest and secondary growth, but nowhere common.
Chlorocichla simplex	Simple Greenbul (Leaf-love)	L		One at the Lokutu Airstrip.
Chlorocichla flavicollis	Yellow-throated Leaf-love (Greenbul)	E		Abundant along Congo River and other major water bodies.
Criniger chloronotus	Eastern Bearded Greenbul	L		Several in a mixed-species party in forest near Lokomete.
Criniger calcurus	Red-tailed Greenbul	L		Fairly common in heavy forest growth.
Bleda syndactyla	Red-tailed Bristlebill	FL		Three birds in forest near Mosite and Lokomete.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
Bleda ugandae	Yellow-eyed Bristlebill	L		One in forest near Lokutu and one near Lokomete, both associated with safari ant swarms.
Baeopogon indicator	Honeyguide Greenbul	FL		Several times on edge of thick forest.
Thescelocichla leucopleura	Swamp Palm Bulbul	FL		One pair in dense riverine thicket near Lokomete.
Ixonotus guttatus	Spotted Greenbul	E		The most widespread greenbul; throughout forest areas and edges of clearings.
Nicator chloris	Western Nicator	L		Widespread in forest sites but in low densities.
Nicator vireo	Yellow-throated Nicator	L		One along Lokutu Airstrip and one in dense Sago Palm swamp. Not a true forest species, but an inhabitant of dense thicket and swampy areas. According to range map in Fry and Keith (2000), the distribution of this species is poorly known in the Congo Basin. These records extends the range of the northeastern population slightly to the northwest.
TURDIDAE				
Neocossyphus fraseri	Fraser's Rufous Thrush (Rufous Flycatcher-thrush)	L		Encountered fairly often, but being a very territorial and aggressive species it could be the same individuals recorded on several occasions.
Turdus pelios	African Thrush	E		Fairly common around Lokutu and satellite settlements.
Pseudalethe castanea	Fire-crested Alethe	L		Two in forest near Lokomete, once attending a safari ant swarm.
Stiphrornis xanthogaster	Eastern Forest Robin	FL		One calling in forest near Lolobo. Although the bird sounded just like birds from East Africa, different populations have different calls. Not being familiar with this area, there was always the possibility of confusion with both Grey Longbill (*Macrosphenus concolor*) and Grey-headed Sunbird (*Deleornis axillaries*), though this is unlikely. In any case, Lokutu is well within the species' range so expected to occur.
Saxicola rubetra	Whinchat	E	PM	Two on Lokutu Airstrip. Although apparently the first records for the Congo Basin (Keith et al. 1992), this species is expected.
SYLVIIDAE				
Acrocephalus schoenobaenus	Sedge Warbler	L	PM	One on a gravel island in Congo River opposite Lokutu.
Phylloscopus trochilus	Willow Warbler	E	PM	Fairly common along Congo River and in open areas around Lokutu.
Cisticola erythrops	Red-faced Cisticola	H		Fairly common around Lokutu in dense scrubby and moist patches. Range map in Urban et al. (1997) does not show this species in the central Congo Basin. Lokutu records extend the range at least 250 km southwest of the nearest known population. Presence at Lokutu may be dependent upon man-made habitats.
Cisticola anonymus	Chattering Cisticola	E		Common throughout in open country with rank growth. Not found, however, in forest clearings.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
Cisticola marginatus	Winding Cisticola	E		Fairly abundant in damp, grassy depressions and swampy margins on river islands.
Prinia subflava	Tawny-flanked Prinia	E		Common in rank undergrowth, riverine edge, and settled areas throughout. Probably occurs naturally along major rivers, and has also entered into man-made habitats. According to range map in Urban et al. (1997), this is a range extension of ca. 100 km to the southwest.
Schistolais leucopogon	White-chinned Prinia	E		Common in open situations and rank growth with vine tangles, but not in forest. Lokutu appears to be on the edge of the species' range. The range of this species circumnavigates those forests of the Congo Basin situated south of the Congo River (Sinclair and Ryan 2003). Lokutu appears to be on the southern edge of the northeast part of the species' range.
Eremomela badiceps	Rufous-crowned (Brown-crowned) Eremomela	FL		Group of five (including juveniles) along Congo River at Lokutu. Strangely absent from forested areas where it was expected to be common.
Sylvietta virens	Green Crombec	E		Common throughout in forest edge, rank growth in moist areas, breaks in the forest and clearings.
Sylvietta denti	Lemon-bellied Crombec	L		Encountered twice in forest near Lokomete and heard singing as part of the very weak dawn chorus. Based on the map in Urban et al. (1997), this is a new locality record among a scattering of sites for this species in the northwestern Congo Basin.
Camaroptera brevicaudata	Grey-backed Camaroptera	E		Common around Lokutu with lower density around satellite settlements. None in the forest.
Camaroptera superciliaris	Yellow-browed Camaroptera	FL		Two, both in swampy open depressions in forest near Lokomete.
Hylia prasina	Green Hylia	H		Very abundant inside the forest, forest edge, and secondary forest.
Macrosphenus flavicans	Yellow Longbill	L		Two in forest near Lokomete.
MUSCICAPIDAE				
Muscicapa caerulescens	Ashy (Blue-grey) Flycatcher	L		One on forest edge near Lunua River.
Muscicapa striata	Spotted Flycatcher	E	PM	Fairly common in open areas and found once inside riverine forest.
MONARCHIDAE				
Terpsiphone viridis	African Paradise Flycatcher	E		Common in open situations and scrubby growth, but not in the forest.
Terpsiphone batesi	Bate's Paradise Flycatcher	U		One in mixed-species flock in forest near Lokomete.
Terpsiphone rufiventer	Red-bellied Paradise Flycatcher	E		One of the most common birds of the forest interior.
Trochocercus nitens	Blue-headed Crested Flycatcher	L		One family near stream near Lokomete.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
Erythrocercus mccallii	Chestnut-capped Flycatcher	L		Three pairs in forest near Lokomete. According to range map in Urban et al. (1997), there are few records for this species south of the Congo River. Lokutu represents an extension of the range of the northeastern population about 50 km south and across the Congo River.
PLATYSTEIRIDAE				
Megabyas flammulatus	African Shrike Flycatcher	FL		Fairly common in canopy of forest and thick secondary growth.
Bias musicus	Black-and-white (Vanga) Flycatcher	FL		One pair in Lokutu and second pair near Mosite.
Platysteira cyanea	Brown-throated (Common) Wattle-eye	E		Fairly common in scrubby and open areas around Lokutu and along Congo River.
Dyaphorophyia castanea	Chestnut Wattle-eye	E		Common throughout forested areas.
LANIIDAE				
Lanius collurio	Red-backed Shrike	E	PM	Up to three birds at Lokutu Airstrip and one along Congo River. Lokutu in known southern migration route.
MALACONOTIDAE				
Dryoscopus senegalensis	Red-eyed (Black-shouldered) Puffback	L		One pair on edge of Lokutu Town. This a slight extension of known range (Fry and Keith 2000) of northeastern population southwards across the Congo River.
Laniarius leucorhynchus	Lowland Sooty Boubou	L		Encountered about four times in dense growth in deforested areas.
STURNIDAE				
Lamprotornis purpureiceps	Purple-headed Starling	FL		Encountered only a few times and in small numbers.
Lamprotornis splendidus	Splendid Glossy Starling (Splendid Starling)	E		Flock of ca. 60 along Congo River, otherwise small parties around Lokutu.
Grafisia torquata	White-collared Starling	U		Flock of >20 feeding in fruiting tree along Congo River a few kilometres up-river from Lokutu. In DRC, known only from a small area in the northeast near the Sudan border (Fry and Keith 2000). Lokutu is first site in the Congo Basin or anywhere south of the Congo River. This is an extension of the known range of this very restricted range species of ca. 450 km to the southwest.
NECTARINIIDAE				
Anthreptes aurantium	Violet-tailed Sunbird	L		One pair along Congo River near Lokutu. May be a low-density species, sharing its habitat with Olive Sunbird (*Cyanomitra olivaceum*), Olive-bellied Sunbird (*Cinnyris chloropygia*), and Collared Sunbird (*Hedydipna collaris*).
Deleornis axillaris	Grey-headed Sunbird	L		Fairly common inside forest.
Anthreptes rectirostris	Grey-chinned (Green) Sunbird	L		Scarce. A few in forest edge.
Hedydipna collaris	Collared Sunbird	L		Widespread in small numbers in forest edge and riverine scrub.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
Chalcomitra rubescens	Green-throated Sunbird	L		A few in forest, a little more common around Lokutu.
Cyanomitra cyanolaema	Blue-throated Brown Sunbird	L		Fairly common in forest, secondary growth and clearings.
Cyanomitra olivacea	Olive Sunbird	H		Probably the most abundant interior forest species. Also in secondary growth and along the rivers.
Cinnyris congensis	Congo (Black-bellied) Sunbird	U		One near Lokutu Airstrip. Range restricted to the Congo River and major tributaries. Lokutu is near the eastern limit of the known range.
Cinnyris superbus	Superb Sunbird	L		A few in clearings and on forest edge.
Cinnyris johannae	Johanna's Sunbird	E		Encountered only three times, once near Lokomete, once along Congo River, and once at Mosite where three were in one tree.
Cinnyris chloropygia	Olive-bellied Sunbird	E		Very common in forest edge, scrub, riverine vegetation, and forest clearings.
Cinnyris minulla	Tiny Sunbird	L		One pair in scrub along Congo River.
PLOCEIDAE				
Passer griseus	Northern Grey-headed Sparrow	E		Common at Lokutu and satellite settlements.
Ploceus aurantius	Orange Weaver	E		Small numbers at several places along rivers, including a male nest-building near Lokutu. A slight addition to the range for the species, but not unexpected.
Ploceus cucullatus	Village (Spotted-backed) Weaver	E		Common in open areas, in man-made habitats, and along rivers.
Ploceus pelzelni	Slender-billed Weaver	E		Fairly common around Lokutu and in riverine vegetation.
Ploceus nigricollis	Black-necked Weaver	E		Common in open areas, secondary and scrubby growth, and riverine forest. Flocks of up to 30 at Lokutu. Whereas in the eastern part of its range this species is solitary or in pairs, in the Congo Basin and in West Africa it is gregarious during the dry season (Fry and Keith 2004).
Ploceus melanocephalus	Black-headed (Yellow-backed) Weaver	E		A few in a very small Papyrus bed on island in Congo River downstream from Lokutu.
Ploceus tricolor	Yellow-mantled Weaver	L		One in mixed bird party in forest near Lokomete.
Ploceus nigerrimus	Vieillot's Black Weaver	E		Common around Lokutu, especially when going to roost along the airstrip. Small numbers over much of the area, even entering the forest to feed in the canopy.
Malimbus rubricollis	Red-headed Malimbe	FL		One inside forest near Lokomete.
Malimbus nitens	Blue-billed (Gray's) Malimbe	L		One near Mosite.
Malimbus cassini	Cassin's (Black-throated) Malimbe	L		The most abundant Malimbe at Lokutu. Nest being built near Mosite, and three sightings in forest near Lokomete.
Quelea erythrops	Red-headed Quelea	L		A few in rank grass along river at Lokomete.

continued

Species	Common name	Abundance	Palearctic migrant	Notes
Brachycope anomala	Bob-tailed Weaver	E		Several pairs and small parties near buildings and gardens at Lokutu and Lokomete. Male building nest ca. 3 m up on outer limb of Mango tree next to occupied building. Endemic to the Congo Basin.
Euplectes afer	Yellow-crowned (Golden) Bishop	E		Five, including two males in breeding plumage, in swamp on island in Congo River downstream from Lokutu.
Vidua macroura	Pin-tailed Whydah	E		Common at Lokutu, particularly around the airstrip. Host species not identified although plain plumaged juveniles seen.
ESTRILDIDAE				
Nigrita fusconotus	White-breasted Nigrita (Negrofinch)	FL		Encountered three times on forest edge near Mosite and Lokomete.
Nigrita canicapillus	Grey-headed Nigrita (Negrofinch)	FL		A few around Lokutu in cleared areas and a few elsewhere.
Pyrenestes ostrinus	Black-bellied Seedcracker	H		Singles seen throughout area and pair nest-building in garden at Lokutu.
Spermophaga haematina	Western Bluebill	E		About five encountered along rivers and in cultivation. In far more open situations than other *Spermophaga* spp. Extension of range about 100 km up the Congo River (Fry and Keith 2004).
Spermestes cucullata	Bronze Mannikin	E		Common in open areas, but not as numerous as Black-and-white Mannikin (*Spermestes bicolor*).
Spermestes bicolor	Black-and-white Mannikin	E		Common in grasslands throughout area and in forest clearings.
Estrilda melpoda	Orange-cheeked Waxbill	E		Abundant in grasslands, open areas, and along rivers.
Estrilda nonnula	Black-crowned Waxbill	E		Common in grasslands, but less abundant than Black-headed Waxbill (*Estrilda atricapilla*).
Estrilda atricapilla	Black-headed Waxbill	E		Widespread in small parties in rank grasslands, often associating with both Black-crowned Waxbill (*Estrilda nonnula*) and Orange-cheeked Waxbill (*Estrilda melpoda*). All were of the west Central Africa subspecies *avakubi.*

Abundance key:
E - as expected
L - lower than expected
FL - far lower than expected
H - higher than expected
P - probably more abundant than records indicate
D - difficult to assess abundance
U - no experience with species and no means of assessing relative abundance

Appendix 4

The Avifaunas of Lola ya Bonobo Sanctuary, DRC

Brian Finch and Klaas-Douwe B. Dijkstra

After returning to Kinshasa, two nights were spent (10–12 November 2004) at the Lola ya Bonobo Sanctuary (S 04º 29' 12.1"; E 15º 16' 01.6"), about a 40 minutes drive southwest from Kinshasa, and ca. 1,100 km southwest of Lokutu. The Lola ya Bonobo Sanctuary is on very undulating land with steep valleys cut by seasonal streams. Some hills are completely denuded with the slopes covered by short grass, but some steeper slopes have remnant patches of scrub with scattered trees. At the Sanctuary there is still a fringe of riverine vegetation, and small areas of dense dry scrub, much cultivation, and some thick moist forest inside the main bonobo enclosure and along the small stream that runs past it.

On the one full day at Lola ya Bonobo Sanctuary, 94 species of birds were recorded in and around the Sanctuary, and an additional six species were recorded early the following morning. A number of the species were those expected at Lokutu, but apparently absent there. A list of the bird species recorded is presented below. Many more bird species will certainly be added to this list.

The list follows the order and taxonomy of Sinclair and Ryan (2003). If the name given differs from that source, the Sinclair and Ryan name is given in brackets. Names of 'special species' (largely confined to western Central Africa) are given in bold.

Family	Species	Common Name
Podicipedidae	*Tachybaptus ruficollis*	Little Grebe
Scopidae	*Scopus umbretta*	Hamerkop
Ardeidae	*Egretta garzetta*	Little Egret
Ardeidae	*Bubulcus ibis*	Cattle Egret
Accipitridae	*Kaupifalco monogrammicus*	Lizard Buzzard
Phasianidae	*Pternistes afer*	Red-necked Spurfowl
Rallidae	*Sarothrura pulchra*	White-spotted Flufftail
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper
Columbidae	*Streptopelia semitorquata*	Red-eyed Dove
Columbidae	*Treron calva*	African Green Pigeon
Columbidae	*Turtur afer*	Blue-spotted Wood Dove
Columbidae	*Turtur tympanistra*	Tambourine Dove
Cuculidae	*Chrysococcyx caprius*	Diderik Cuckoo
Cuculidae	*Chrysococcyx klaas*	Klaas's Cuckoo
Cuculidae	*Chrysococcyx cupreus*	African Emerald Cuckoo
Cuculidae	*Ceuthmochares aereus*	Yellowbill (Blue Malkoha)
Cuculidae	*Centropus senegalensis*	Senegal Coucal
Strigidae	*Strix woodfordi*	African Wood Owl
Apodidae	*Cypsiurus parvus*	African Palm Swift
Apodidae	*Apus affinis*	Little Swift

continued

Family	Species	Common Name
Apodidae	*Telecanthura ussheri*	Mottled Spinetail
Coliidae	*Colius striatus*	Speckled Mousebird
Alcedinidae	*Alcedo cristata*	Malachite Kingfisher
Alcedinidae	*Ispidina picta*	African Pygmy Kingfisher
Alcedinidae	*Halcyon albiventris*	Brown-hooded Kingfisher
Alcedinidae	*Megaceryle maxima*	Giant Kingfisher
Meropidae	*Merops gularis*	Black Bee-eater
Meropidae	*Merops breweri*	**Black-headed Bee-eater**
Meropidae	*Merops pusillus*	Little Bee-eater
Bucerotidae	*Tockus fasciatus*	African Pied Hornbill
Capitonidae	*Pogonolius scolopaceus*	Speckled Tinkerbird
Capitonidae	*Pogonolius bilineatus*	Yellow-rumped Tinkerbird
Capitonidae	*Pogonolius subsulphureus*	Yellow-throated Tinkerbird
Alaudidae	*Mirafra africanoides*	Flappet Lark
Hirundinidae	*Psalidoprocne pristoptera*	Black Saw-wing
Hirundinidae	*Hirundo rustica*	Barn Swallow
Hirundinidae	*Hirundo abyssinica*	Lesser Striped Swallow
Hirundinidae	*Hirundo semirufa*	Red-breasted Swallow
Motacillidae	*Motacilla aguimp*	African Pied Wagtail
Corvidae	*Corvus alba*	Pied Crow
Timaliidae	*Illadopsis rufipennis*	Pale-breasted Illadopsis
Pycnonotidae	*Pycnonotus tricolor*	Dark-capped Bulbul
Pycnonotidae	*Pycnonotus barbatus*	Common Bulbul
Pycnonotidae	*Andropadus latirostris*	Yellow-whiskered Greenbul
Pycnonotidae	*Andropadus virens*	Little Greenbul
Pycnonotidae	*Chlorocichla simplex*	Simple Greenbul
Pycnonotidae	*Chlorocichla falkensteini*	**Yellow-necked Greenbul (Falkenstein's Greenbul)**
Pycnonotidae	*Nicator vireo*	Yellow-throated Nicator
Turdidae	*Neocossyphus poensis*	White-tailed Ant Thrush (White-tailed Rufous Thrush)
Turdidae	*Turdus pelios*	African Thrush
Turdidae	*Cossypha natalensis*	Red-capped Robin Chat
Turdidae	*Cichladusa ruficauda*	**Rufous-tailed Palm Thrush**
Turdidae	*Cercotrichas leucophrys*	White-browed Scrub Robin
Sylviidae	*Melocichla mentalis*	African Moustached Warbler (Moustached Grass Warbler)
Sylviidae	*Phylloscopus trochilus*	Willow Warbler
Sylviidae	*Cisticola erythrops*	Red-faced Cisticola
Sylviidae	*Cisticola anonymus*	Chattering Cisticola
Sylviidae	*Cisticola brachypterus*	Siffling Cisticola (Short-winged Cisticola)
Sylviidae	*Prinia subflava*	Tawny-flanked Prinia
Sylviidae	*Schistolais leucopogon*	White-chinned Prinia
Sylviidae	*Sylvietta virens*	Green Crombec
Sylviidae	*Hylia prasina*	Green Hylia
Sylviidae	*Camaroptera brevicaudata*	Grey-backed Camaroptera
Muscicapidae	*Muscicapa cassini*	Cassin's Flycatcher
Muscicapidae	*Muscicapa caerulescens*	Ashy Flycatcher
Monarchidae	*Terpsiphone rufocinerea*	**Rufous-vented Paradise Flycatcher**

continued

Family	Species	Common Name
Platysteiridae	*Batis minulla*	**Angola Batis**
Malaconotidae	*Dryoscopus senegalensis*	Red-eyed Puffback
Malaconotidae	*Tchagra senegala*	Black-crowned Tchagra
Malaconotidae	*Laniarius leucorhynchus*	Sooty Boubou (Lowland Sooty Boubou)
Malaconotidae	*Telephorus viridis*	**Perrin's Bush-Shrike**
Nectariniidae	*Chalcomitra fuliginosa*	**Carmelite Sunbird**
Nectariniidae	*Chalcomitra rubescens*	Green-throated Sunbird
Nectariniidae	*Cyanomitra olivacea*	Olive Sunbird
Nectariniidae	*Hedydipna collaris*	Collared Sunbird
Nectariniidae	*Anthreptes rectirostris*	Grey-chinned Sunbird
Nectariniidae	*Cinnyris chloropygia*	Olive-bellied Sunbird
Nectariniidae	*Cinnyris cupreus*	Copper (Coppery) Sunbird
Nectariniidae	*Cinnyris superbus*	Superb Sunbird
Passeridae	*Passer griseus*	Northern Grey-headed Sparrow
Ploceidae	*Ploceus cucullatus*	Village Weaver
Ploceidae	*Ploceus melanocephalus*	Black-headed Weaver (Yellow-backed Weaver)
Ploceidae	*Pachyphanthes superciliosus*	Compact Weaver
Ploceidae	*Quelea quelea*	Red-billed Quelea
Ploceidae	*Euplectes macroura*	Yellow-mantled Widowbird
Estrildidae	*Nigrita bicolor*	Chestnut-breasted Negrofinch (Chestnut-breasted Nigrita)
Estrildidae	*Nigrita luteifrons*	Pale-fronted Negrofinch (Pale-fronted Nigrita)
Estrildidae	*Parmoptila woodhousei*	**Woodhouse's Antpecker**
Estrildidae	*Clytospiza monteiri*	Brown Twinspot
Estrildidae	*Lagonosticta rubricata*	African Firefinch
Estrildidae	*Pyrenestes ostrinus*	Black-bellied Seedcracker
Estrildidae	*Spermophaga haematina*	Western Bluebill
Estrildidae	*Spermestes cucullata*	Bronze Mannikin
Estrildidae	*Spermestes bicolor*	Black-and-White Mannikin
Estrildidae	*Uraeginthus angolensis*	Southern Cordon-bleu (Blue Waxbill)
Estrildidae	*Amandava subflava*	Zebra Waxbill (Orange-breasted Waxbill)
Estrildidae	*Estrilda perreini*	Grey Waxbill
Estrildidae	*Estrilda melpoda*	Orange-cheeked Waxbill
Viduidae	*Vidua macroura*	Pin-tailed Whydah
Fringillidae	*Serinus mozambicus*	Yellow-fronted Canary

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South America

* Bolivia: Alto Madidi Region. Parker, T.A. III and B. Bailey (eds.). 1991. A Biological Assessment of the Alto Madidi Region and Adjacent Areas of Northwest Bolivia May 18 - June 15, 1990. RAP Working Papers 1. Conservation International, Washington, DC.

* Bolivia: Lowland Dry Forests of Santa Cruz. Parker, T.A. III, R.B. Foster, L.H. Emmons and B. Bailey (eds.). 1993. The Lowland Dry Forests of Santa Cruz, Bolivia: A Global Conservation Priority. RAP Working Papers 4. Conservation International, Washington, DC.

† Bolivia/Perú: Pando, Alto Madidi/Pampas del Heath. Montambault, J.R. (ed.). 2002. Informes de las evaluaciones biológicas de Pampas del Heath, Perú, Alto Madidi, Bolivia, y Pando, Bolivia. RAP Bulletin of Biological Assessment 24. Conservation International, Washington, DC.

* Bolivia: South Central Chuquisaca Schulenberg, T.S. and K. Awbrey (eds.). 1997. A Rapid Assessment of the Humid Forests of South Central Chuquisaca, Bolivia. RAP Working Papers 8. Conservation International, Washington, DC.

* Bolivia: Noel Kempff Mercado National Park. Killeen, T.J. and T.S. Schulenberg (eds.). 1998. A biological assessment of Parque Nacional Noel Kempff Mercado, Bolivia. RAP Working Papers 10. Conservation International, Washington, DC.

* Bolivia: Río Orthon Basin, Pando. Chernoff, B. and P.W. Willink (eds.). 1999. A Biological Assessment of Aquatic Ecosystems of the Upper Río Orthon Basin, Pando, Bolivia. RAP Bulletin of Biological Assessment 15. Conservation International, Washington, DC.

§ Brazil: Rio Negro and Headwaters. Willink, P.W., B. Chernoff, L.E. Alonso, J.R. Montambault and R. Lourival (eds.). 2000. A Biological Assessment of the Aquatic Ecosystems of the Pantanal, Mato Grosso do Sul, Brasil. RAP Bulletin of Biological Assessment 18. Conservation International, Washington, DC.

§ Ecuador: Cordillera de la Costa. Parker, T.A. III and J.L. Carr (eds.). 1992. Status of Forest Remnants in the Cordillera de la Costa and Adjacent Areas of Southwestern Ecuador. RAP Working Papers 2. Conservation International, Washington, DC.

* Ecuador/Perú: Cordillera del Condor. Schulenberg, T.S. and K. Awbrey (eds.). 1997. The Cordillera del Condor of Ecuador and Peru: A Biological Assessment. RAP Working Papers 7. Conservation International, Washington, DC.

* Ecuador/Perú: Pastaza River Basin. Willink, P.W., B. Chernoff and J. McCullough (eds.). 2005. A Rapid Biological Assessment of the Aquatic Ecosystems of the Pastaza River Basin, Ecuador and Perú. RAP Bulletin of Biological Assessment 33. Conservation International, Washington, DC.

§ Guyana: Kanuku Mountain Region. Parker, T.A. III and A.B. Forsyth (eds.). 1993. A Biological Assessment of the Kanuku Mountain Region of Southwestern Guyana. RAP Working Papers 5. Conservation International, Washington, DC.

* Guyana: Eastern Kanuku Mountains. Montambault, J.R. and O. Missa (eds.). 2002. A Biodiversity Assessment of the Eastern Kanuku Mountains, Lower Kwitaro River, Guyana. RAP Bulletin of Biological Assessment 26. Conservation International, Washington, DC.

* Paraguay: Río Paraguay Basin. Chernoff, B., P.W. Willink and J. R. Montambault (eds.). 2001. A biological assessment of the Río Paraguay Basin, Alto Paraguay, Paraguay. RAP Bulletin of Biological Assessment 19. Conservation International, Washington, DC.

* Perú: Tambopata-Candamo Reserved Zone. Foster, R.B., J.L. Carr and A.B. Forsyth (eds.). 1994. The Tambopata-Candamo Reserved Zone of southeastern Perú: A Biological Assessment. RAP Working Papers 6. Conservation International, Washington, DC.

* Perú: Cordillera de Vilcabamba. Alonso, L.E., A. Alonso, T. S. Schulenberg and F. Dallmeier (eds.). 2001. Biological and Social Assessments of the Cordillera de Vilcabamba, Peru. RAP Working Papers 12 and SI/MAB Series 6. Conservation International, Washington, DC.

* Suriname: Coppename River Basin. Alonso, L.E. and H.J. Berrenstein (eds.). 2006. A rapid biological assessment of the aquatic ecosystems of the Coppename River Basin, Suriname. RAP Bulletin of Biological Assessment 39. Conservation International, Washington, DC.

* Venezuela: Caura River Basin. Chernoff, B., A. Machado-Allison, K. Riseng and J.R. Montambault (eds.). 2003. A Biological Assessment of the Aquatic Ecosystems of the Caura River Basin, Bolívar State, Venezuela. RAP Bulletin of Biological Assessment 28. Conservation International, Washington, DC.

* Venezuela: Orinoco Delta and Gulf of Paria. Lasso, C.A., L.E. Alonso, A.L. Flores and G. Love (eds.). 2004. Rapid assessment of the biodiversity and social aspects of the aquatic ecosystems of the Orinoco Delta and the Gulf of Paria, Venezuela. RAP Bulletin of Biological Assessment 37. Conservation International, Washington, DC.

* Venezuela: Ventuari and Orinoco Rivers. C. Lasso, J.C. Señarìs, L.E. Alonso, and A.L. Flores (eds.). 2006. Evaluación Rápida de la Biodiversidad de los Ecosistemas Acuáticos en la Confluencia de los ríos Orinoco y Ventuari, Estado Amazonas (Venezuela). Boletín RAP de Evaluación Biológica 40. Conservation International. Washington DC, USA.

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Asia-Pacific

* Indonesia: Wapoga River Area. Mack, A.L. and L.E. Alonso (eds.). 2000. A Biological Assessment of the Wapoga River Area of Northwestern Irian Jaya, Indonesia. RAP Bulletin of Biological Assessment 14. Conservation International, Washington, DC.

* Indonesia: Togean and Banggai Islands. Allen, G.R., and S.A. McKenna (eds.). 2001. A Marine Rapid Assessment of the Togean and Banggai Islands, Sulawesi, Indonesia. RAP Bulletin of Biological Assessment 20. Conservation International, Washington, DC.

* Indonesia: Raja Ampat Islands. McKenna, S.A., G.R. Allen and S. Suryadi (eds.). 2002. A Marine Rapid Assessment of the Raja Ampat Islands, Papua Province, Indonesia. RAP Bulletin of Biological Assessment 22. Conservation International, Washington, DC.

* Indonesia: Yongsu - Cyclops Mountains and the Southern Mamberamo Basin. Richards, S.J. and S. Suryadi (eds.). 2002. A Biodiversity Assessment of Yongsu — Cyclops Mountains and the Southern Mamberamo Basin, Papua, Indonesia. RAP Bulletin of Biological Assessment 25. Conservation International, Washington, DC.

* Papua New Guinea: Lakekamu Basin. Mack, A.L. (ed.). 1998. A Biological Assessment of the Lakekamu Basin, Papua New Guinea. RAP Working Papers 9. Conservation International, Washington, DC.

† Papua New Guinea: Milne Bay Province. Werner, T.B. and G. Allen (eds.). 1998. A Rapid Biodiversity Assessment of the Coral Reefs of Milne Bay Province, Papua New Guinea. RAP Working Papers 11. Conservation International, Washington, DC.

* Papua New Guinea: Southern New Ireland. Beehler, B.M. and L.E. Alonso (eds.). 2001. Southern New Ireland, Papua New Guinea: A Biodiversity Assessment. RAP Bulletin of Biological Assessment 21. Conservation International, Washington, DC.

* Papua New Guinea: Milne Bay Province. Allen, G.R., J.P. Kinch, S.A. McKenna and P. Seeto (eds.). 2003. A Rapid Marine Biodiversity Assessment of Milne Bay Province, Papua New Guinea — Survey II (2000). RAP Bulletin of Biological Assessment 29. Conservation International, Washington, DC.

† Philippines: Palawan Province. Werner, T.B. and G. Allen (eds.). 2000. A Rapid Marine Biodiversity Assessment of the Calaminanes Islands, Palawan Province, Philippines. RAP Bulletin of Biological Assessment 17. Conservation International, Washington, DC.

Africa & Madagascar

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† Côte d'Ivoire: Marahoué National Park. Schulenberg, T.S., C.A. Short and P.J. Stephenson (eds.). 1999. A Biological Assessment of Parc National de la Marouhe, Côte d'Ivoire. RAP Working Papers 13. Conservation International, Washington, DC.

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* Ghana: Southwestern forest reserves. McCullough, J., J. Decher, and D.G. Kpelle. (eds.). 2005. A biological assessment of the terrestrial ecosystems of the Draw River, Boi-Tano, Tano Nimiri and Krokosua Hills forest reserves, southwestern Ghana. RAP Bulletin of Biological Assessment 36. Conservation International, Washington, DC.

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* Guinea: Southeastern. Wright, H.E., J. McCullough, L.E. Alonso and M.S. Diallo (eds.). 2006. Rapid biological assessment of three classified forests in Southeastern Guinea. RAP Bulletin of Biological Assessment 40. Conservation International, Washington, DC.

* Guinea: Northwestern. Wright, H.E., J. McCullough and M.S. Diallo. (eds). 2006. A rapid biological assessment of the Boké Préfecture, Northwestern Guinea. RAP Bulletin of Biological Assessment 41. Conservation International, Washington, DC.

* Liberia: Hoke, P., R. Demey and A. Peal (eds.). 2007. A rapid biological assessment of North Lorma, Gola and Grebo National Forests, Liberia. RAP Bulletin of Biological Assessment 44. Conservation International, Arlington, VA, USA.

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* Madagascar: Mantadia-Zahamena. Schmid, J. and L.E. Alonso (eds). 2005. Une evaluation biologique rapide du corridor Mantadia-Zahamena, Madagascar. RAP Bulletin of Biological Assessment 32. Conservation International, Washington, DC.

Madagascar: Northwest Madagascar. McKenna, S.A. and G.R. Allen (eds). 2003. A Rapid Marine Biodiversity Assessment of the Coral Reefs of Northwest Madagascar. RAP Bulletin of Biological Assessment 31. Conservation International, Washington, DC.

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