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Detectability and Conservation of De Brazza's Monkey (*Cercopithecus neglectus*) in the Lesio-Louna and South-west Lefini Reserves, Bateke Plateau, Republic of Congo

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Abstract: The Lesio-Louna and south-west Lefini Reserves in the Bateke Plateau region of the Republic of Congo are not generally included as part of the geographic range of de Brazza's monkey (*Cercopithecus neglectus*). I present here observations made between 2002 and 2007 showing the species to be widely distributed within the gallery forests of the two reserves. Most sight records were of one or two individuals, although groups of up to six were also observed. De Brazza's monkeys could be heard calling on approximately 50% of days at project camps, and it was the most frequently detected large mammal during MacKinnon List surveys. Detectability was significantly lower during surveys that began after 07:00, a finding that may explain why the species has been largely overlooked during structured wildlife surveys. A review of grey literature suggests that the reserve management activities linked to a gorilla reintroduction program have led to recovery of the species following years of heavy hunting. However, the connectivity of the gallery forests of the Lefini watershed to the major forest areas to the east is threatened by human activity. The maintenance of forest corridors to avoid isolation of the gallery forests may be an important consideration for the long-term sustainable management of the region.

Key words: Protected area management, species recovery, gorilla reintroduction, gallery forests

Résumé: Les Réserves de Lesio-Louna et sud-ouest Lefini, situées dans la région du Plateau Bateke de la République du Congo, ne sont généralement pas incluses au sein de l'aire de répartition géographique du cercopithèque de Brazza *Cercopithecus neglectus*. Je présente ici des observations faites entre 2002 et 2007, montrant que l'espèce est largement distribuée dans les forêts-galeries des deux réserves. La plupart des observations concernaient un ou deux individus, bien que des groupes contenant jusqu'à six animaux aient également été observés. Des cercopithèques de Brazza pouvaient être entendus depuis les camps du projet environ 50% des jours, et il était le grand mammifère le plus fréquemment détecté au cours des études effectuées pour les Listes MacKinnon. La détectabilité était sensiblement plus basse lors des études commencées après 07:00, ce qui pourrait expliquer pourquoi l'espèce a été largement négligée au cours d'études structurées de la faune. Une révision de la littérature grise suggère que les activités de gestion de la réserve liées à un programme de réintroduction de gorilles ont conduit au rétablissement de l'espèce après des années de pression de chasse énorme. Néanmoins, la connectivité entre les forêts-galeries du bassin de la Lefini et les principales zones forestières situées à l'est est menacée par l'activité humaine. Le maintien de corridors forestiers pour éviter l'isolement des galeries forestières peut être un facteur important à prendre en considération pour la gestion durable de la région à long terme.

Mots-clés: Gestion d'aire protégée, rétablissement d'espèce, réintroduction de gorilles, galeries forestières

Introduction

De Brazza's monkey (*Cercopithecus neglectus*) is a relatively widespread species closely associated with rivers across forested regions of central Africa. In most standard works, the Bateke Plateau region of the Republic of Congo is not included within the species' geographic range (for example, Gautier-Hion *et al.* 1999; Kingdon 2001), probably due in part to the region being largely grassland-dominated. A few

recent records from the gallery forests of the Bateke Plateau prompted Maisels *et al.* (2007) to revise the recognized range limits of the species. These limits can be refined further by including records from the Lesio-Louna and south-west Lefini Reserves in Congo, where the species has been one of the most frequently observed large mammals during the past decade (this paper). Known in the local Teke language as Mbouni, it is also heavily hunted by local populations (F. Ikoli and R. Missilou-Boukaka in litt.). I present here an analysis of

data collected on the species in the two reserves from 2002 to 2007, discuss why such a detectable species has been generally under-recorded during structured mammalian surveys in and around the reserves, and review the grey literature to try to evaluate past and future conservation issues regarding the species in the area.

Site Description

The Lesio-Louna and Lefini Reserves lie approximately 140 km north of Brazzaville in the Republic of Congo (Fig. 1). The Lefini Reserve was created in 1951, covering approximately 400,000 ha, and was enlarged to 630,000 ha in 1963. The Lesio-Louna Reserve is an area of 44,000 ha adjacent to the eastern boundary of the south-west portion of the Lefini Reserve (Fig. 1). It was created in 1993 as a sanctuary for the reintroduction of gorillas orphaned by the illegal bushmeat trade, and was upgraded to a Natural Reserve in 1999. The gorilla reintroduction program was gradually transferred from the original Lesio-Louna to the south-west portion of the Lefini Reserve between 2003 and 2007 (King and Chamberlan 2007a). The Lesio-Louna and south-west Lefini Reserves are currently managed through a joint partnership project between the UK-based charity The Aspinall Foundation and the government of Congo. The project employs over twenty patrol staff trained in anti-poaching and monitoring techniques, and its aims are fairly standard for protected areas in the region, except for the rather unique addition of gorilla reintroduction.

The two reserves form part of the Bateke Plateau, an expanse of savannah and gallery forests extending from

south-east Gabon through central Congo and southern DRC to northern Angola. The Plateau is covered with deep Kalahari sands, which date from the Eocene period, around 50 million years ago, and extend south in a fairly narrow strip through western central Africa and Botswana to northern South Africa (Walters *et al.* 2006). Much of the plateau has been eroded away, leaving a mosaic of remaining smaller plateaus, often delimited by dramatic sandstone escarpments, separated by watercourses and extensive areas of gently rolling, grassy, sand dunes. The watercourses are bordered by gallery forest, up to 3 km wide in the south-west of Lefini, and made up of permanently or seasonally flooded swamp forest, grading into drier forest before the abrupt transition with lightly wooded grassland. The climate of the reserves is similar to that elsewhere on the plateau, with a dry season from late May to September, the heaviest rains in October–November and March–April, and a drier period around January–February. Rainfall in 2006 at two sites in the reserves was 1,500 and 2,000 mm (King 2008). The altitude ranges from 300 m to 750 m above sea level. The savannah in and outside the reserve is burned regularly by local users, perhaps four or five times per year in places. These fires sometimes spread into forest patches, particularly in the latter parts of the dry season.

In addition to de Brazza's monkeys, the Reserves support various forest and savannah mammals, including mustached monkey (*Cercopithecus cephus*), vervet monkey (*Cercopithecus aethiops pygerythrus*), side-striped jackal (*Canis adustus*), leopard (*Panthera pardus*), hippopotamus (*Hippopotamus amphibius*), red river hog (*Potamochoerus porcus*), forest buffalo (*Syncerus caffer nanus*), bushbuck (*Tragelaphus*

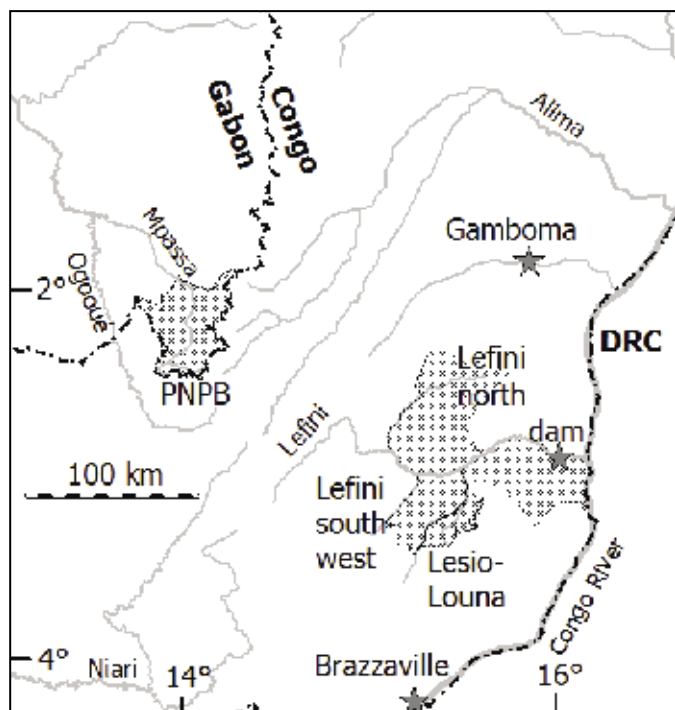


Figure 1. Location of the Lesio-Louna and south-west Lefini Reserves and other protected areas (shaded) in the Bateke Plateau region of Congo and Gabon, plus major rivers and the approximate location of the hydroelectric dam currently under construction on the Lefini River.

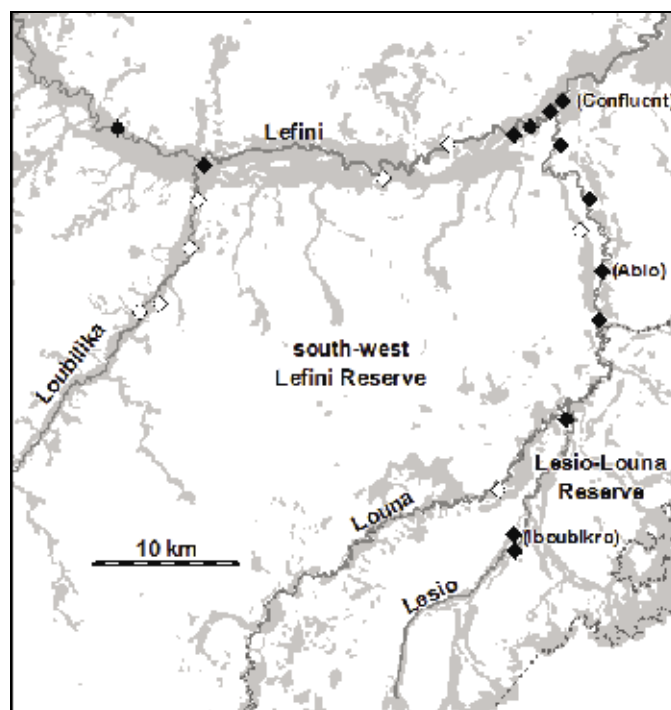


Figure 2. Locations of De Brazza's monkey observations presented in this paper (black diamonds), plus additional selected observations by project patrol teams (white diamonds, R. Missilou-Boukaka unpubl. data), forest cover (grey areas), rivers (dark grey), and project base-camps (in parentheses).

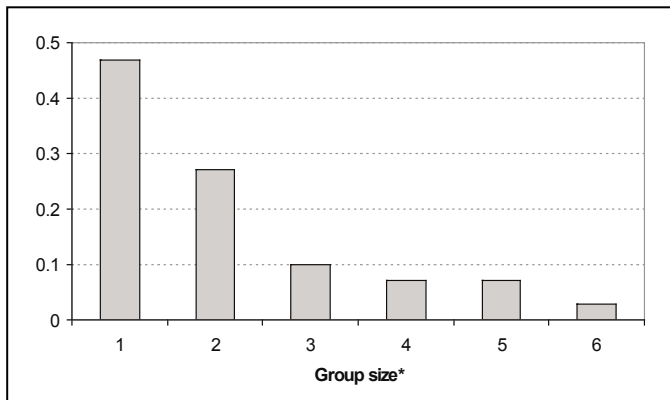


Figure 3. Proportion of direct observations of de Brazza's monkeys in the Lesio-Louna and south-west Lefini Reserves by group size (*in some sightings group members may have been overlooked).

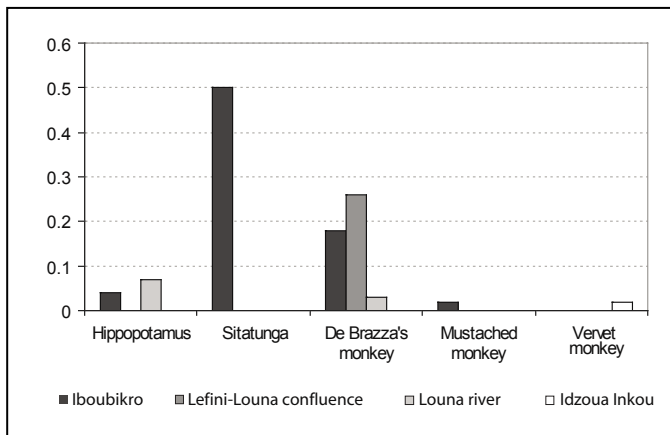


Figure 4. IRDs (Indices of Relative Detectability) for the five most detectable large mammal species during MacKinnon List bird surveys at four sites in the Lesio-Louna and south-west Lefini Reserves, 2003 to 2007. (Site locations given in Fig. 2, except Idzoua Inkou, which represents an area of wooded grassland near Iboubikro).

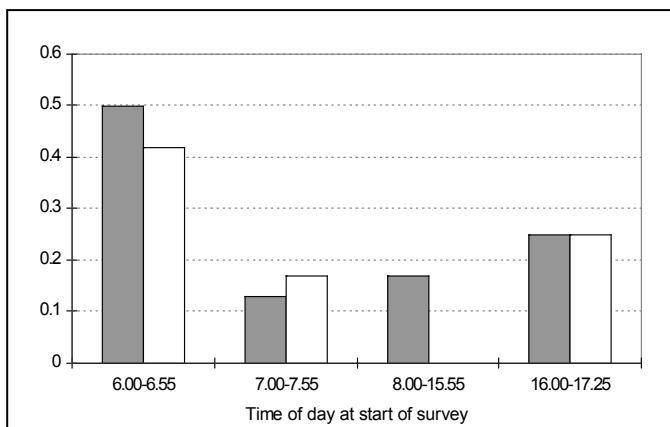


Figure 5. Impact of time of day of beginning MacKinnon List surveys on IRDs for de Brazza's monkeys at the Lefini-Louna confluence (grey bars) and Iboubikro (white bars).

scriptus), sitatunga (*T. spekei*), bush duiker (*Sylvicapra grimmia*) and various forest duikers (*Cephalophus* spp.). Some forest elephants (*Loxodonta africana cyclotis*) persist in the northern and eastern sectors of the Lefini Reserve, and chimpanzees (*Pan troglodytes*) can be found west of the southern sector.

Methods

The data presented here were collected between late 2002 and early 2007 through opportunistic observations while based in the reserves, and through two structured studies. In the first of these, daily records were kept of de Brazza's monkey observations at the Lesio-Louna management base-camp of Iboubikro during a five-month period from July to December 2002 in order to quantify monthly fluctuations in detectability. In the second, a variation on the MacKinnon List technique (Bibby *et al.* 1998) was used as a semi-quantitative method of surveying the birds of the two reserves from December 2003 to April 2007 (King 2008), during which mammal observations were also recorded. Five principle sites were visited on a regular basis over the three-year period, each visit lasting long enough to record at least ten bird species. The survey allowed the calculation of "Indices of Relative Detectability" (IRD) for the mammals, representing the proportion of combined sight and sound observations for each species recorded during the surveys at each site (other observations, such as tracks or feces, were not included).

Results

De Brazza's monkeys were seen 116 times in the Lesio-Louna and Lefini Reserves. We did not include the majority of vocalizations heard outside the specific survey periods as they were too numerous to note. This total consists of 77 records made during the five-month period in 2002 when daily observations were noted at the Iboubikro base-camp, 23 records during the semi-quantitative bird survey, and a further 16 that were opportunistic. Thirty of the records were sightings, 85 were vocalizations only, and one was of an adult found, half-swallowed by dead rock python (*Python sebae*) in July 2003, both animals evidently died during the encounter.

The species was seen at twelve locations spread throughout the two reserves, although always in gallery forest along watercourses, particularly the Lesio, Louna and Lefini rivers (Fig. 2). The Loubilika River was not adequately surveyed, although two observations along the Lefini River, on both sides of its confluence with the Loubilika, indicate that the species is likely to be equally abundant in the Loubilika gallery forests. This has been confirmed by a number of sightings by project monitoring teams along the Loubilika River (R. Missilou-Boukaka unpubl. data; Fig. 2). Previous wildlife surveys also recorded the species along the Nambouli River; the western boundary of the north Lefini Reserve (Downer 1998; Ikoli *et al.* 1998; Maisels *et al.* 2007; see Fig. 1).



Figure 6. Gallery, swamp and escarpment forest along the Louna valley, Lesio-Louna and Lefini Reserves, Congo. Photo by T. King.



Figure 7. De Brazza's monkey in typical riverside gallery forest vegetation at Iboubikro, Lesio-Louna Reserve. Photo by T. King.

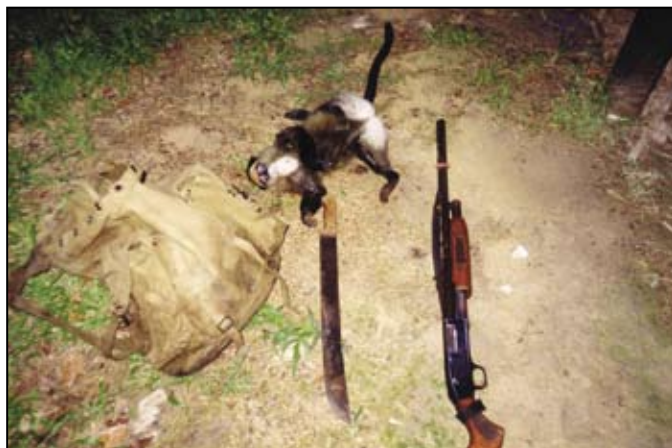


Figure 8. De Brazza's monkeys are a popular target amongst local hunters living around the Lesio-Louna and Lefini Reserves. Photo by The Aspinall Foundation.

No more than six individuals were seen in any one group in the 30 recorded sightings. Most observations were of one (47%) or two (27%) individuals (Fig. 3), but these figures are minimum group sizes, as others may have been overlooked. In October 2002, we saw a female with a small baby in a group of about four. We detected de Brazza's monkeys on 77 of 140 observation days at Iboubikro (between 8 July and 16 December 2002); a combined observation rate of 55% of days. On the majority of occasions (65 of 77; 84%) we only heard them. Monthly observation rates were similar ($\chi^2_5 = 10.257$, n.s.).

De Brazza's monkeys were the most widely and frequently detected of the five large mammal species recorded during the MacKinnon List bird survey periods (Fig. 4), although it was not detected at survey sites far from gallery forests. The time of day that the surveys were carried out influenced the IRD values for the species (Fig. 5). At the two sites where the species was regularly recorded (Iboubikro and Lefini-Louna confluence), IRD values were significantly higher for surveys that started between 06:00 and 07:00 than for those begun after 07:00 (0.45 and 0.10 respectively, $\chi^2_1 = 9.867$, $P < 0.01$), although IRD values increased to some extent after 16:00 (Fig. 5).

Discussion

In recent years, de Brazza's monkeys have proven to be the most detectable mammal species in the Lesio-Louna and south-west Lefini Reserves of the Bateke Plateau region of Congo, based on sightings and calls heard at sites along major watercourses. Why, then, has the region only recently been recognized as within the species range (Maisels *et al.* 2007)? A review of the grey literature of the past fifteen years or so regarding the reserves suggests that the gorilla reintroduction program and the associated protected area management project have allowed the species to recover from excessive hunting in the reserves. Initial investigation of the proposed Lesio-Louna Reserve as a site for the gorilla project in the early 1990s concluded that de Brazza's monkeys had been locally extirpated (Bailey *et al.* 1996). In the mid-1990s, once the gorilla rehabilitation and reintroduction project had begun its activities near the Lesio River in the heart of the Reserve, de Brazza's and vervet monkeys were recorded as the only primates in the area, although both were regarded as "sparse" (Furley 1996). During 1998, four years after the installation of project activities in the Lesio-Louna, the species was found to be the only primate widespread in gallery forest along the Lesio River, with observations north to Lac Sampion (PPG 1998). By 1999, project staff from local villages were proud that wildlife in general, including de Brazza's monkeys, were visibly more abundant in the Lesio-Louna since the installation of the project in 1994 (King 2000). Around the same time, wildlife surveys in the neighboring Lefini Reserve recorded de Brazza's monkeys along the Nambouli and Lefini rivers (Downer 1998, Ikoli *et al.* 1998). It was the only primate actually sighted during the surveys (twice), although local

guides claimed that both de Brazza's and mustached monkeys were more abundant than the few records suggested (Downer 1998). As had previously occurred in the Lesio-Louna, the initiation of the gorilla reintroduction program in the south-west Lefini Reserve in 2003, and the associated reserve management activities, appeared to promote the recovery of wildlife populations in the area, including de Brazza's monkeys (King 2005).

Despite this apparent recovery in recent years, a wildlife survey across the Lesio-Louna and Lefini Reserves in 2005 only recorded one vocalization of de Brazza's monkeys during the survey periods, along with two sightings outside the survey periods (Nganga *et al.* 2006; Maisels *et al.* 2007). Two aspects of the methodology used during the study can explain this lack of observations. The first was the coverage of the zone by foot, causing a survey bias away from the swampy riverside forest that is the preferred habitat of the species. Their calls, however, can carry several hundreds of meters (Gautier-Hion *et al.* 1999), and so can be recorded even from outside of the habitat. In the Lesio-Louna and south-west Lefini, vocalizations are concentrated in the early morning. Surveys begun before 07:00 were three times more likely to record de Brazza's monkeys than those begun between 07:00 and 08:00 (Fig. 5). Vocalizations were even rarer through the rest of the day, until after 16:00 when they were recorded at rates roughly half of those for surveys before 07:00. The 2005 mammal survey, which was based more on the frequency of tracks and sign than sightings and calls, was undertaken by daily surveys between 07:30 and 17:00 (Nganga *et al.* 2006). The primary opportunity to locate groups by their calls was therefore missed. Future surveys should consider a daily recording of calls between 06:00 and 07:00, perhaps by one team member while the others break camp and prepare for the day.

The observations given here refine further the known limits of the range of de Brazza's monkey. As Maisels *et al.* (2007) recognized, the species may well prove to be distributed throughout the major remaining gallery forests of the Bateke Plateau. The Aspinall Foundation also runs a western gorilla reintroduction project in the Bateke Plateau National Park (PNPB) in Gabon (Fig. 1); a program similar to that in the Lesio-Louna and south-west Lefini Reserves in Congo. Since establishing a base-camp in the heart of the park in 1998, project staff have still to hear or see de Brazza's monkeys along the Mpassa River, the major watercourse running through it (L. Pearson and P. Aczel pers. comm.; T. King pers. obs.). While intensive wildlife surveys have now recorded the species on a few occasions elsewhere in the park (Bout 2006; Maisels *et al.* 2007), the rarity of the species in the PNPB in the west of the Bateke Plateau, compared to its relative abundance in the Lesio-Louna and south-west Lefini Reserves, suggests that the population of the Lefini watershed region is, or at least was, connected primarily to populations to the east, along the Congo River, and probably also into the Democratic Republic of Congo, given the well known ability of the species to swim across rivers. Such connectivity of the Lefini fauna with the forests of the DRC has been demonstrated with

the recent discovery of a breeding colony of Sladen's Barbet (*Gymnobucco sladeni*) in the Lesio-Louna Reserve, a bird otherwise virtually endemic to the forests of DRC (King and Chamberlan 2007b). This connectivity between the forests of the Congo River and the gallery forests of the Lefini watershed is now threatened, partly by the growing human population and related deforestation and hunting pressure along the Lefini River (for example, Downer 1998), but possibly even more importantly by the future flooding of a large forest area following the ongoing construction of a hydroelectric dam on the Lefini River towards its confluence with the Congo River (Fig. 1). The project, planned for completion in 2009, is likely to have many unforeseen environmental and socioeconomic impacts, some of which may not become apparent for many years (McCartney 2007). One is that the gallery forests of the Lefini watershed, and their associated forest fauna, may become virtually isolated from the major forest block to the east. The affect of such isolation may be unpredictable, but the maintenance of forest corridors between the Lefini watershed and the forest blocks to the east and west should be one of many considerations for the sustainable long-term management of the Bateke Plateau region as a whole.

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