



## **Gorilla reintroduction, Republic of Congo**

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## Part 1. Introduction

The western gorilla (*Gorilla gorilla gorilla*) is recognised as globally endangered (IUCN 2003), and in the light of recent evidence it has been proposed to be reclassified as critically endangered (Walsh *et al.* 2003). The reasons for this have been identified as over-exploitation of the species' forest habitat, commercial hunting for bush-meat and the subsequent illegal trade in orphans, and, only recently fully recognised, the devastating threat of the ebola virus (Walsh *et al.* 2003).

The John Aspinall Foundation (JAF), a British charity founded by the late John Aspinall (Courage & Harvey 2003), in cooperation with the governments of the Republic of Congo (since 1987) and of Gabon (since 1998), set up the Projet Protection des Gorilles (PPG) for the overall goal to work with local partners for the conservation of indigenous endangered species in general, and of gorillas in particular (*Accord de Coopération en matière de protection des gorilles entre le Gouvernement de la République du Congo et la Fondation de Howletts et Port Lympne*, 7/4/1993).

To achieve this goal, PPG is involved in several distinct but related activities in the two range countries:

- The reduction of the trade in orphan gorillas, and consequently the illegal bush-meat trade, by repression (facilitating confiscation of illegally held gorillas by the national governments) and by prevention (information, awareness, education).
- The rehabilitation of confiscated orphan gorillas into a natural forest habitat, for the conservation and individual welfare of these 'ambassadors' of their species.
- The reintroduction of gorillas into protected areas within the former range of the species.
- The management of these areas for the restoration and the protection of their natural resources.
- The promotion of local, national and international awareness of the threats facing the species.
- The development of sustainable conservation-minded activities which provide economic benefits on a local and national scale.

This report will concentrate on summarising the reintroduction aspects of the PPG programme in Congo, but will also touch on other aspects of the Congo programme as they relate to the reintroduction. Part 2 gives a summary of the PPG Congo confiscation and rehabilitation programmes, as the rehabilitation provides the release stock for the reintroduction programme. Part 3 summarises very basically the first reintroduction attempt, in the Lesio-Louna Reserve, abandoned after eight years due to the lack of sufficient ecological barriers between the released gorillas and human activity. Part 4 summarises the ongoing second reintroduction attempt in Congo, in the neighbouring Lefini Reserve and using appropriate individuals from the first attempt, analysing the programme with reference to the IUCN guidelines on non-human primate reintroductions (IUCN 2002).

## Part 2. Confiscation and Rehabilitation: A brief summary

PPG-Congo was conceived in 1987 as a long-term response to the constant flow of orphan gorillas (*Gorilla gorilla*) arriving in Brazzaville, the capital city of the Republic of Congo (Attwater 1990a, Attwater 1999). By 1989, an orphanage had been constructed in the grounds of the Brazzaville Zoo, and the project was ready to receive its first gorilla orphans.

However, the first orphan ape to arrive turned out to be a bonobo, and in the absence of other options at the time, the bonobo was accepted in the hope of that eventually a long-term solution would be found. This solution arrived in the form of Claudine André's bonobo sanctuary on the outskirts of Kinshasa, Lola ya Bonobo. 15 years after his arrival in Congo, that first bonobo was finally repatriated to his native Democratic Republic of Congo (DRC) in April 2004. During those 15 years, 84 orphan gorillas and 19 other orphan bonobos were received by PPG-Congo. In 2005 we published a report summarising our experiences during that time (May 1989 to May 2004, King *et al.* 2005d), the major results and conclusions being the following:

- The arrival rate of gorilla orphans decreased markedly from an average rate of 10 per year between 1990 and 1994 to 1.4 per year between 2000 and 2004, while in contrast, bonobo orphans arrived at a relatively constant rate of 1.2 to 1.4 per year. (After the report was written, one more bonobo was received during 2004, and in 2005 no gorillas or bonobos were received – see Fig. 1).

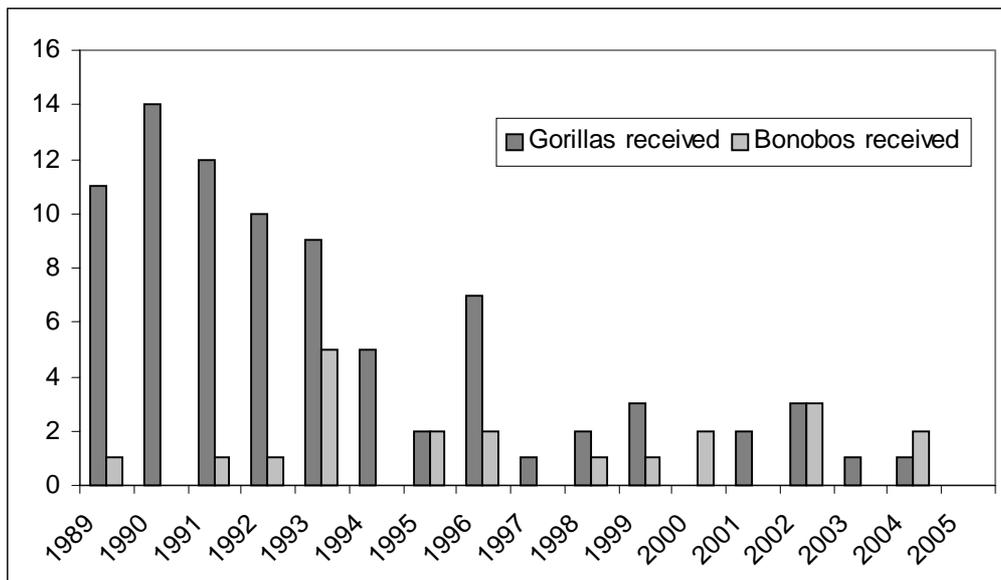


Fig. 1. Gorilla and bonobo arrivals at PPG-Congo, May 1989 – Dec 2005 (updated from King *et al.* 2005d)

- 45% of the gorillas, & 24% of the bonobos, died during the first two months after arrival. After two months, mortality rates were similar between the two species.
- Emotional stress appears to be a major influence in the high mortality of orphan gorillas during the first two months following arrival, a factor which does not appear to be significant for bonobos.
- Emotional stress appears to be more significant as a cause of mortality in older than in younger gorilla arrivals (Fig 2.).

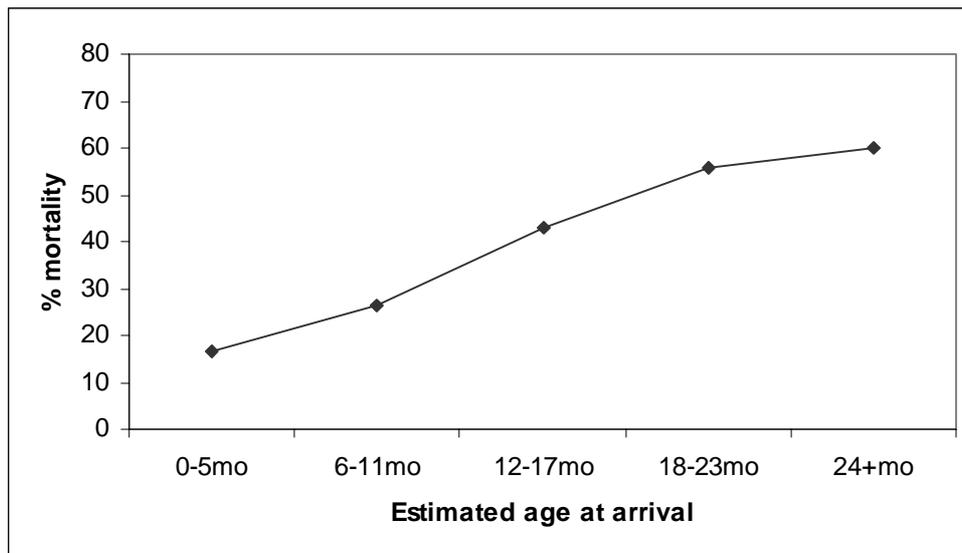


Fig 2. Mortality rates during the first two months following arrival for orphan gorillas of different ages at arrival (adapted from King *et al.* 2005d).

- Older gorillas that survive the initial two-month period following arrival appear to have a higher survival rate than younger gorillas.
- Emotional stress also appears to be at least partly responsible for several deaths of gorillas over three years after their arrival.
- Disease as a cause of death in gorilla and bonobo orphans has been reduced dramatically since moving the orphanage away from the city of Brazzaville and into more isolated areas.
- Following release of rehabilitated gorillas, attacks by older gorillas on younger gorillas became a further cause of mortality. This has been reduced, at least for the time-being, by changing the release strategies.
- 8 of the 20 bonobos survived and have been repatriated to DRC.
- 21 of the 84 gorillas survived and live in the Lesio-Louna & Lefini Reserves.

### Part 3. Lesio-Louna: the first reintroduction

The Lesio-Louna Gorilla Sanctuary was created in 1993, through an agreement between JAF and the Ministry of Forest Economy and the Environment (MEFE) of the government of Congo (*Protocole d'accord portant création du Sanctuaire Lesio-Louna pour la réinsertion et la protection des gorilles entre le Gouvernement de la République du Congo et la Fondation de Howletts et Port Lympne*, 28/12/1993), primarily for the release of the gorillas under the care of PPG at the Brazzaville Orphanage (Attwater 1994). The area was upgraded to the

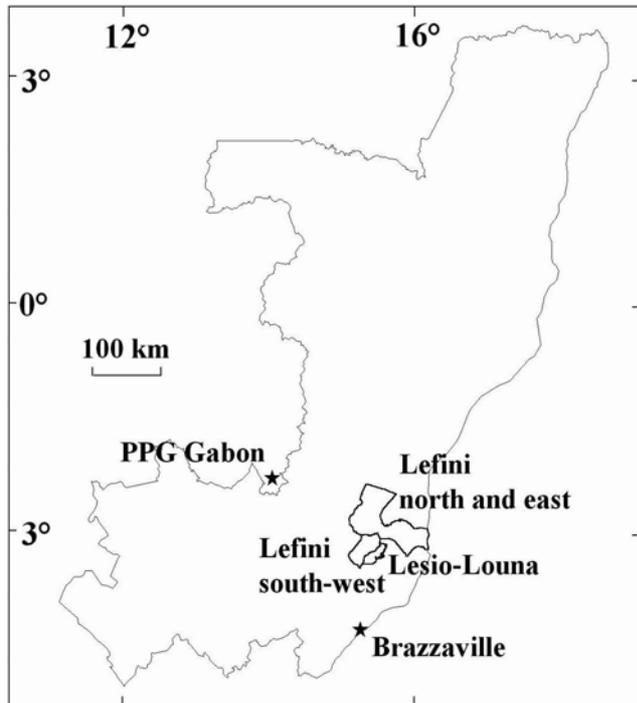


Fig 3. Location of Lesio-Louna and south-west Lefini Reserves, Republic of Congo.

status of Natural Reserve and officially titled “Réserve Naturelle de Gorilles de Lesio-Louna” through a Presidential Decree in December 1999 (*Décret no 99-309 du 31 décembre 1999 portant création et organisation de la réserve naturelle de gorilles de Lésio-Louna*). The Reserve is situated on the Bateke Plateaux, roughly 140 km north of Brazzaville, and covers almost 500 km<sup>2</sup> (Fig. 3, Courage *et al.* 2001, Courage 2002, King *et al.* 2004b). The major habitat of the reserve is rolling savanna grassland with gallery and swamp forests along the water-courses, plus some patches of dry forest on higher ground (Moutsamboté 1994, Dowsett-Lemaire 1997, King *et al.* 2004b). The reserve is currently managed through a joint JAF-MEFE partnership project, created through a partnership protocol in 2002 (*Protocole d'accord sur l'aménagement et la gestion de la Réserve Naturelle de gorilles de Lésio-Louna*) and officially titled ‘Projet Lesio-Louna’.

The first gorillas were transferred from Brazzaville in 1994. Pre-release procedures, whether in Brazzaville or Lesio-Louna and generally over a period of several years, included (Attwater 1990a, 1994):

- formation of relatively even-aged groups based on dates of arrival
- daily activities in large non-enclosed forest
- night in cages
- supplementary feeding: milk & fruits/vegetables
- close human contact & supervision
- medical care & vaccination (MMR & DTPolio; also BCG & Hep B in early years)

Four groups were released, between 1996 and 2001, consisting of a total of 22 gorillas (Table 1). Release and post-release procedures included:

- Groups 1 to 3: release in same forest area used for final pre-release procedures
- Group 4: release approximately 10 km away from pre-release phase (transported by vehicle)

- established groups, social bonds formed during lengthy pre-release phase
- free-ranging (but movements influenced if necessary)
- reduced human contact & supervision
- occasional feeding as management tool
- medical care provided if required
- anti-poaching activities

Table 1. Gorilla releases in the Lesio-Louna Reserve, Congo

	Date	Males	Females	Total
Group 1	Apr 1996	2	1	3
Group 2	May 1996	3	0	3
Group 3	Dec 1998	3	4	7
Group 4	Jun 2001	4	5	9
Total		12	10	22

The released gorillas adapted well to the reintroduction site (Courage *et al.* 2001, Courage & Harvey 2003, King *et al.* 2003). Group ranges increased progressively (Mbani Akangala 1998b). Over 100 species of plant were utilised as food sources (Mbani Akangala 1998a, Cousins 2002), and ‘natural’ social behaviours such as female transfer were observed (King *et al.* 2004a, King 2005b). Three of the released gorillas died (1 ♂ & 1 ♀ following attacks by older gorillas, 1 adult ♂ following a stressful event; King *et al.* 2005d), and one female disappeared, presumed dead. Therefore, of 22 released, 18 survived, a survival rate of 81.8 %. However, four adult males had to be caged, and the remaining 14 gorillas were transferred to the south-west Lefini in 2003 and 2004. After 8 years, and despite the successful adaptation of the gorillas to the site, the Lesio-Louna reintroduction was abandoned due to the lack of effective ecological barriers between the released gorillas and human activity. This manifested itself in several negative ways:

- occasional direct contact between the released gorillas and local people exercising their user rights within the Reserve;
- occasional indirect contact – one sub-adult female had to have her right hand amputated after it had been trapped in a metal snare;
- regular raids on project camps by gorillas looking for easy food;
- the arrival of solitary adult males in local villages or fields surrounding the Reserve.

The small rivers and steep escarpments present in the Lesio-Louna (Attwater 1994) proved insufficient in discouraging gorilla movements, as indeed did electric fences for protecting project camps (Watkin 2002, King 2005a). If one big lesson was learnt during the Lesio-Louna experience, it was that while the general area for a gorilla reintroduction may be identified through consideration of several ecological, sociological and political criteria, the presence of effective ecological barriers between the released gorillas and human activity should define the specific site for release.

#### **Part 4. South-west Lefini: the second attempt. An analysis of the preparations and initial results of the gorilla reintroduction to the Lefini Reserve, in reference to the IUCN guidelines for non-human primate reintroductions**

From the conception of the Brazzaville gorilla orphanage in 1987, through the rehabilitation and first reintroduction attempt in the Lesio-Louna from 1994, 16 years of preparation preceded the first release of western gorillas to the Lefini Reserve in January 2003. Here we summarise those preparations, describe the implementation of that release and of the second release in September 2004, and present the initial results of the post-release monitoring. We analyse all aspects of the reintroduction programme by reference to the guidelines on non-human primate reintroductions given by the World Conservation Union (IUCN 2002). More extensive details can be found in our annual reports of the Lefini reintroduction programme (King *et al.* 2004a, 2005a,b, 2006).

##### *Aim of reintroduction programme*

As given earlier, the goal of PPG is to work with local partners for the conservation of indigenous endangered species in general, and of gorillas in particular, and gorilla reintroduction is one of several activities carried out by PPG in Congo to achieve this goal. As stipulated by IUCN (2002), the principal aim of the reintroduction programme is to re-establish a viable, self-sustaining population of the western gorilla in the wild.

The aims of the reintroduction site itself are given in the 1999 Presidential decree creating the Lesio-Louna Reserve (to which the south-west Lefini will soon be legally annexed), and are fairly standard for protected areas, except for the rather unique addition of gorilla reintroduction:

- To assure, conforming with the two 1993 agreements with JAF, the reintroduction of orphan gorillas;
- To protect the gorillas and the ecosystem of the reserve;
- To organise and promote education, training, outreach, and biodiversity research;
- To promote and develop, in collaboration with appropriate services, tourism;
- To organise, with local community participation, an integrated system of natural resource protection in the reserve.

##### *Precautionary Principle*

JAF recognises the risks involved in reintroducing orphan gorillas to the wild, both to the released individuals themselves and to indigenous wild populations of the species (Attwater 1990b). The following justifications can be made, in response to the terms stated by IUCN (2002).

- The reintroduction programme is believed to contribute to the national and global conservation of this endangered and charismatic species.
- JAF provides a long-term management commitment to undertake the programme in accordance to conservation guidelines, and to ensure the welfare of the released individuals.
- The release sites have been selected in areas with no existing indigenous wild populations.
- Full release of individuals is approved only after several years of intense monitoring and medical assessments.

- Release has already been tried in the Lesio-Louna Reserve over several years, and this experience has demonstrated that the presence of the gorillas and of the project has a positive impact on the habitat and biodiversity of the area.

#### *Habitat and release site*

Following several JAF & MEFE missions, in 2002 the south-west sector of the Lefini Faunal Reserve was proposed as a suitable site for the reintroduction programme (Bockandza & Mbani Akangala 2002). Some features of the site:

- adjacent to the Lesio-Louna Reserve (Fig. 3)
- already protected under Congolese law (Elenga & Ikoli 1996, Ikoli 1998)
- size: 1,200 km<sup>2</sup>
- within the species former range
- wild great apes hunted out in living memory (GEF c1990, Bailey *et al.* 1996, Ampolo & Nongamani 1998, Downer 1998)
- most other large mammals (appendices 1 & 2) either disappeared or at low densities (GEF c1990, Ikoli *et al.* 1998, Downer 1998)
- major natural barriers (3 large rivers & vast expanse savanna)
- habitat & botanical surveys conducted with comparison to gorilla diet (Attwater *et al.* 1992, Moutsamboté 1994, 1999, Mbani Akangala 1998a, Cousins 2002, King *et al.* 2004a)
- interspecific competition unlikely as chimpanzees (*Pan troglodytes*), a species known to occupy a fairly similar ecological niche (Tutin *et al.* 1991, Tutin & Fernandez 1993, Kuroda *et al.* 1996), had also been extirpated (GEF c1990, Ampolo & Nongamani 1998, Downer 1998), while other primate species had been found to be at low densities (GEF c1990, Ikoli *et al.* 1998, Downer 1998) and would likely benefit from protection from hunting
- GIS developed in 2002 using the 1:200 000 maps of IGN (1961) (King *et al.* 2004a), and updated with satellite maps in 2005 (King *et al.* 2006)
- 47 km<sup>2</sup> forest along Lefini river + 53 km<sup>2</sup> associated forests
- potential carrying capacity of the site calculated by combining published data on densities of the western gorilla in natural habitats (Kuroda *et al.* 1996, Blom *et al.* 2001) with a spatial analysis of the south-west Lefini (King *et al.* 2004a).

#### *Species socioecology and behaviour*

Studies of the western gorilla in the wild were reviewed in 2002 to aid understanding of the needs of a reintroduced population, and to help predict and assess the future progress of the population. Some relevant data are summarised below.

- At Mbeli Bai, Congo, excluding solitary males, mean group size was found to be 8.4 (sd 4.3), of which 6.6 (sd 3.2) were weaned, results not significantly different to most other gorilla studies (Parnell 2002).
- Stable groups generally consist of one adult male with several adult females (median = 3.0), with a variable number of immatures (Parnell 2002).
- Limits on group size may be imposed by intra-group feeding competition due to relatively low density of herbaceous vegetation (Parnell 2002).
- Non-dominant males usually leave group at 14-15 years old (Tutin 1996).
- Groups are often formed by an adult female joining a solitary male (Parnell 2002).

- Solitary males generally do not form all-male groups (Parnell 2002).
- Most contact between solitary males is characterised by mutual avoidance or agonistic display (Parnell and Buchan-Smith 2001, Parnell 2002).
- In a day, groups in Lopé, Gabon, were reported to travel between 220 m and 2.8 km, although longer distances may have been overlooked (Tutin 1996).
- Groups travel further when fruit is abundant than when scarce (Tutin 1996).
- One group in Lopé had a core home range of about 10 km<sup>2</sup>, but covered 21 km<sup>2</sup> during a 10 year period (Tutin 1996).
- There is extensive over-lap between the home ranges of different groups (Tutin 1996).
- Solitary males may track groups for several days (Tutin 1996).
- Encounters between two groups often occurred near concentrations of ripe fruit; usually one group would leave following vocal or chest-beating interaction (Tutin 1996).
- 64% of nest sites were on the ground (Tutin *et al.* 1995).
- Ground nests predominate in areas with high densities of herbaceous plants (Tutin *et al.* 1995).
- Tree nests were more frequent in areas where herbaceous plants were rare and during wet months (Tutin *et al.* 1995).
- Several plant species of Marantaceae and Zingiberaceae are consumed more when other food sources are scarce, and therefore may be considered ‘keystone foods’ (White *et al.* 1995, Kuroda *et al.* 1996).

Since the 2002 literature review, much more information has been published concerning wild western gorillas (e.g. see Doran-Sheehy and Boesch 2004). However, access to such papers in Congo is difficult, despite formal and informal contact with many of the researchers involved. Nevertheless, during 2005 a large number of recent papers were amassed in electronic format, and will be reviewed as soon as possible.

#### *Socioeconomic, financial and legal requirements*

- long-term financial and technical commitment from the John Aspinall Foundation
- project management partnership between JAF & Congolese Government
- release site within a legally protected area (since 1951)
- ecological barriers to minimise the possibility of human-wildlife conflicts
- prior socio-economic studies (Ampolo & Nongamani 1998, Downer 1998, 1999)
- compensation for traditional landowners from Government (King *et al.* 2005b)
- extensive & ongoing outreach/awareness programme (Ikoli 2002, 2004, Mabilia & Nitouambi 2002, King *et al.* 2004a, APPC 2005)
- community development & alternative activities initiated in 1997 almost immediately destroyed by the outbreak of civil war
- from 2005, similar activities facilitated, but in conjunction with local non-government organisations, to try to better fulfil community expectations, and to try to instil a sense of national self-help rather than an impression of reliance on, and a right to, foreign aid. These include a community health centre and a small-scale goat breeding programme
- large socio-economic study planned for 2006, in collaboration with WCS, to direct future community participation and development activities

*Release stock & Genetic assessment*

Table 2. Gorilla releases in the south-west Lefini Reserve, Congo

	Date	Males	Females	Total
Group 1	Jan 2003	2	3	5
Group 2	Sep 2004	4	5	9
Group 3	planned 2006	0	3	3
Total		6	11	17

Table 3. Composition of the groups reintroduced, or awaiting imminent reintroduction, to the south-west Lefini.

Name	Sex /Ref	Date of arrival	Region of origin	Wt (kg) on arrival	Estimated age on arrival	Estimated age (Dec 2005)
<i>Male, solitary since May 2004, released with group 1 in Jan 2003</i>						
Bangha	♂2	13/02/92	Kouilou	2.8	4 months	14 years 2 months
<i>Group 1, released Jan 2003 (except ♂7 born post-release)</i>						
Djembo	♀1	12/07/90	Sangha	20	3 years	18 years 5 months
Makoua	♂1	20/04/93	N Congo		1.5 years	14 years 2 months
Lengui	♀2	22/04/94	Cuvette Ouest	5	1.5 years	13 years 2 months
Bougou	♀3	01/10/93	Kouilou	4	10 months	12 years 11 months
Téké	♂7	13/04/04	Born to ♀1	-	0	1 year 8 months
<i>Group 2, released Sep 2004</i>						
Koto	♀4	02/06/96	Kouilou	5	1.5 years	11 years 0 months
Djeke	♂3	10/04/96	Likouala	4	1 year	10 years 8 months
Kelle	♂4	02/10/96	Cuvette Ouest	6.5	6 months	9 years 8 months
Mpoumbou	♀5	02/10/97	Kouilou	5	9 months	8 years 11 months
Pikounda	♂5	15/04/99	Sangha		2 years	8 years 8 months
Massabi	♀6	04/07/98	Kouilou	3	11 months	8 years 4 months
Tchivou	♀7	08/03/99	Kouilou	c5	1 year	7 years 9 months
Kama	♂6	05/10/98	Born in PPG	1.7	0	7 years 2 months
Louboko	♀8	24/11/99	Likouala	3	8 months	6 years 9 months
<i>Group 3, planned for reintroduction in 2006</i>						
Likendzé	♀9	23/10/02	Sangha	8	3.5 years	6 years 8 months
Matoko	♀10	23/10/02	Sangha	7	3.5 years	6 years 8 months
Hélène	♀11	29/06/01	Kouilou	5.5	7 months	5 years 1 months

The release stock is made up of suitable candidates from the PPG-Congo orphan rehabilitation programme (see earlier). The first two releases (Table 2) consisted of individuals that had already been released during the abandoned Lesio-Louna reintroduction. All but one of these gorillas are wild-born orphans originated and confiscated in Congo (Table 3). The one exception is a male born within the project to two wild-born orphans, hand-reared having

been abandoned at birth, and also an orphan as both the mother and presumed-father have since died. All individuals are therefore assumed to be of the same species and subspecies (*Gorilla gorilla gorilla*). Genetic assessment is being considered.

#### *Disease Transmission and Veterinary Requirements*

- long-term daily visual monitoring
- prior to release (details in King *et al.* 2004a, 2005a,b):
  - vaccinations (MMR & DTPolio, previously Hep B)
  - various medical tests (TB, HIV, Hep B) & treatments
- at release:
  - thorough examination
  - vitamin supplements
  - general medications against intestinal worms and external parasites

#### *Staff Screening and Health*

- staff with the project for many years
- health tests on an informal basis
- deworming every three months
- vaccinations against DTPolio, Hep B & Yellow Fever
- other vaccinations under consideration (typhoid, Hep A, MMR)

A health protocol for protected area staff in Gabon is in the process of being developed by the Wildlife Conservation Society (WCS). The Pan African Sanctuary Alliance (PASA) is also currently working to establish best-practice protocol for staff health. Once completed these may be used as a guide for PPG, and a formal health programme may be developed.

#### *Transport & Release Implementation*

- Group 1 (King *et al.* 2004a):
  - 18 Jan 2003
  - 5 caged adults (2 ♂, 3 ♀)
  - darting with *Dan-Inject* rifle
  - transport by truck & boat
- Group 2 (Mahé 2004, King *et al.* 2005a):
  - 8 Sep 2004
  - 9 free-living sub-adults & juveniles (4 ♂, 5 ♀)
  - oral *medetomidine* + IM *ketamine* or *zoletil*
  - transport by pirogues
  - method very successful and recommended for future gorilla anaesthetics where possible
- Group 3:
  - planned for late 2006
  - 3 juvenile females in semi-liberty
  - oral *medetomidine* + IM *ketamine*
  - transport by vehicle and pirogues

## *Post-release Monitoring*

Below is a summary of the major points coming out of our post-release monitoring over the first three years of the Lefini reintroduction. More detailed results are given in our unpublished annual reintroduction reports (King *et al.* 2004a, 2005a,b, 2006)

- no radio-collar system yet developed for gorillas
- daily search for direct or indirect signs of presence (tracks, faeces, chest-beats, visual contact) by teams of 4+
- network of forest trails created but primarily river & savanna-based patrols (safety issues)
- several key-locations for visual contact
- food offered to facilitate visual contact
- simultaneous anti-poaching patrols
- all released gorillas remain in good health
- 13 April 2004: first baby (♂) born to reintroduced gorillas (King 2004), remains in good health
- Group 1 range gradually increasing: 2003: c4 km<sup>2</sup> forest; 2004: c6.4 km<sup>2</sup>; 2005: c10 km<sup>2</sup>.
- Ranging behaviour of group 1 in 2003 similar to wild gorillas: spent a period of six months, including almost the entire dry season when food sources scarce, in a single forest patch of 1.34 km<sup>2</sup>. During the subsequent wet season, the group travelled regularly between forest patches, remaining in any one forest patch no longer than 3.5 weeks
- On at least one occasion in 2003, the group travelled between two of its favourite foraging areas nearing the opposite limits of their range in less than 24 hours, a straight-line distance of 3.3 km. In 2004, in a period of approximately 24-hours, the group travelled a straight-line distance of 3.9 km. These may be compared with the 2.8 km recorded by Tutin (1996) as the maximum distance travelled in a day by her study group, although she recognises that longer distances may have been overlooked
- Ranging behaviour and social dynamics of group 1 altered in 2004: intra-group tension increased following birth in April, ♂2 becoming immediately aggressive and gradually solitary (Fig. 4), finally becoming independent of the group in Nov 2004.
- After a month of solitary exploration outside the group range (Fig. 5), ♂2 encountered group 2 in Dec 2004, and has since remained in the range of group 2 with regular contact, without fully integrating into the group or forming a new group. Encounters are often antagonistic, and the group occasionally splits, with the older females spending a number of days with the 'solitary' ♂2 (Fig. 4).
- A change in the behaviour of the remaining male in group 1 (♂1), and presumed father of the baby born in Apr 2004, was also noted following the birth, as he became gradually more aggressive towards project staff.
- In February 2005, ♂1 became suddenly and unexpectedly solitary. Exploring westwards along the Lefini river, and traversing the Loubilika river representing the western limit of the Reserve, he travelled 31 km in 12 days (Fig. 5) before being localised by staff, anaesthetised with oral *medetomidine* and IM *ketamine*, and returned by pirogue to the original release site. He remained solitary until finally encountering and reuniting with the rest of group 1 four months later. During this period, in April 2005 he also followed the Louna river south for the first time, travelling 13 km in 2 days before an antagonistic encounter with the solitary ♂2 following which he returned to his usual range.

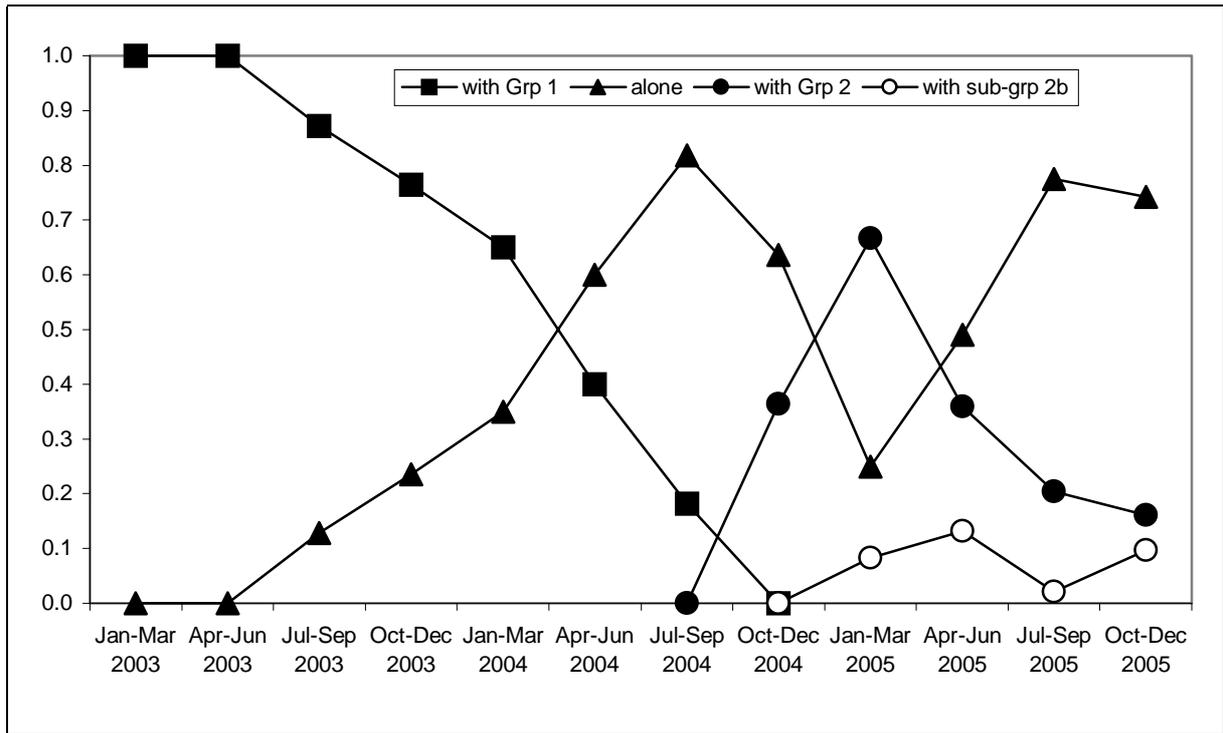


Fig 4. Proportion of direct observations of the increasingly solitary male ( $\text{♂}_2$ ) a) with group 1 (the group with which he was released in Jan 2003); b) alone; c) with group 2 (the second group released to the south-west Lefini, in Sep 2004) and d) with sub-group 2b (variable number of females from group 2).

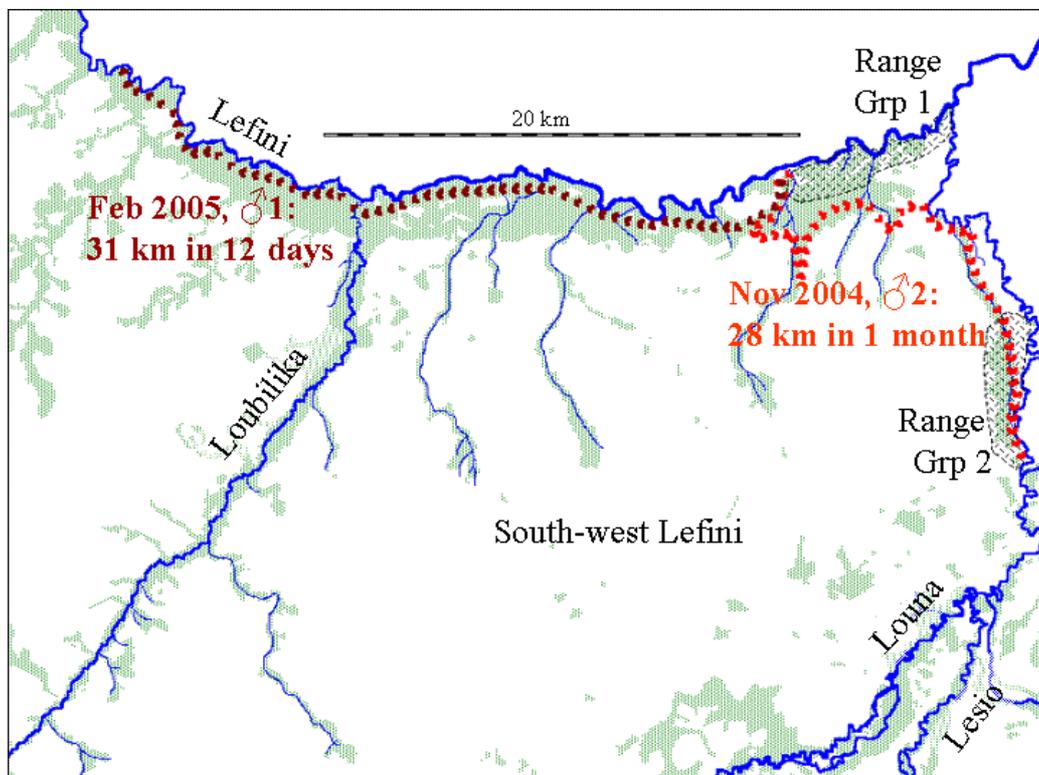


Fig 5. The south-west Lefini reintroduction site, with ranges of groups 1 and 2 as at Dec 2004, and the routes taken by the solitary males  $\text{♂}_2$  in Nov 2004 and  $\text{♂}_1$  in Feb 2005.

- Having remained with group 1 from June 2005, in January 2006 ♂1 repeated his excursion of the previous February, but this time was localised at the Loubilika river. Anaesthetised and returned to the original release site, he was reunited with group 1 the following day and has remained with them since.
- On various occasions, the presence of visitors appeared to have undesirable impacts on the behaviour of the gorillas (King *et al.* 2005c). The most serious case, on 22/06/2004, involved the solitary ♂2, after half an hour of calm observation, jumping from an overhanging tree into the pirogue containing three visitors and five project staff. Four of the project staff fell into the river, leaving the three visitors with one staff member and the adult gorilla in the pirogue as it made a full circle in the river before becoming stuck in riverside vegetation. Fortunately, the gorilla jumped back to land, returning briefly to steal a life-jacket, but made no attempt to aggress the staff or visitors. However, the incident illustrated again the difficulties of taking visitors to over-habituated released gorillas, and could easily have ended with serious injury to the gorilla, the visitors or the staff.

### *Conclusion*

Following the release of group 1 in January 2003, and of group 2 in September 2004, the gorillas have apparently adapted well to the reintroduction site in the south-west Lefini. They remain in good health, and their ranging and social behaviour appears similar to that of wild western gorillas. The birth in April 2004 of the first baby born to reintroduced gorillas was especially encouraging. The site itself can clearly support larger numbers of gorillas than have currently been released, and other indigenous faunal species, such as hippo, buffalo, antelope and monkeys, are seen to benefiting from the increased protection provided by the reserve management project which as a whole could, and probably should, be regarded as an ecosystem restoration project (see King 2005a). The first three years post-release results are therefore very positive in terms of the long-term aim of establishing a viable, self-sustaining gorilla population in the area. We do however recognise three major issues which remain unresolved (King *et al.* 2005c):

1. the genetic viability of a population based on small numbers of rehabilitated individuals
2. the capacity of the area to contain the extensive movements of solitary males (and what to do with solitary males)
3. the impact of human presence, especially of visitors, on the behaviour of the released gorillas

The first issue is a function of our source of release stock, our concurrent orphan confiscation and rehabilitation programmes. As illustrated earlier, the arrival of gorilla orphans at PPG-Congo has fallen dramatically during its 17-year history. Population viability modelling would help assess the long-term future of the reintroduced population.

As in the Lesio-Louna, the Lefini reintroduction has highlighted once again the issue of solitary male ranging and behaviour. This led to significant efforts in 2005 to finally find a long-term solution, primarily based on the evident need to increase the female:male sex ratio of released groups. In the absence of numerous excess females available for release, this would entail the removal of selected males from the reintroduction programme, either temporarily or permanently. Such a strategy would consequently necessitate the formation of

captive or semi-captive groups of surplus adult males, as occurred in the Lesio-Louna. Large electrified enclosures were proposed and investigated, but finally a project was initiated to create a 25 ha forested island on the edge of the reintroduction site that could support one or more males in their natural habitat.

The third major issue, that of the impact of visitor presence on gorilla behaviour, has yet to be fully quantified. However, experience strongly suggests that each individual or group must be assessed separately for their suitability to be visited, and that some kind of barrier must be present between visitors and gorillas. The reintroduction in Congo is being carried out in a protected area with tourism as one of its five objectives, so to realise this objective we currently are trying to promote other aspects of the reserve, such as the magnificent and unique scenery, as the major visitor attraction. Gorilla viewing is not guaranteed, is only permitted with one group, and only from a boat or opposing river bank. Gorilla viewing is also more expensive than other visitor activities in the reserve. Nevertheless, this remains a challenging issue.

After nearly 20 years in Congo, the nature of gorillas and their life-history means we are still in the early stages of the reintroduction programme. A full analysis of the success of the reintroduction may not be possible for at least another decade. Long-term technical and financial commitment is therefore critical to such a programme. The role of PASA as a platform for information sharing should also be considered critical, to ensure that similar projects learn from each other in what remains a new and pioneering conservation discipline.

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Appendix 1. Large mammal species lost from the south-west Lefini Reserve, Republic of Congo (based on GEF c1990, Bailey *et al.* 1996, Ikoli *et al.* 1998, Ampolo & Nongamani 1998, Downer 1998, 1999).

English name	Species	Notes
Central African chimpanzee	<i>Pan troglodytes troglodytes</i>	local people claim some still present west of Loubilika river
Western gorilla	<i>Gorilla gorilla gorilla</i>	local project staff claim one shot near Mâh in 1980s (J. Ombani pers. comm.)
Pennant's Red Colobus	<i>Piliocolobus pennanti bouvieri</i>	restricted range, possibly extinct, endemic sub-species (see Kingdon 2001), unclear if ever present in south-west Lefini
Spotted hyaena	<i>Crocuta crocuta</i>	
Lion	<i>Panthera leo</i>	one observed in 1980s (P. Yoka pers. comm.)
Forest elephant	<i>Loxodonta africana cyclotis</i>	some still present in north & east Lefini Reserve
Southern reedbuck	<i>Redunca arundinum</i>	

Appendix 2. Large mammal species present in the south-west Lefini Reserve, Republic of Congo (based on GEF c1990, Bailey *et al.* 1996, Ikoli *et al.* 1998, Ampolo & Nongamani 1998, Downer 1998, 1999).

English name	Species
Vervet monkey	<i>Cercopithecus (aethiops) pygerythrus</i>
De Brazza's monkey	<i>Cercopithecus neglectus</i>
Moustached monkey	<i>Cercopithecus (cephus) cephus</i>
Potto	<i>Perodicticus potto</i>
Galago	<i>Galagonidae</i> spp.
Side-striped jackal	<i>Canis adustus</i>
Swamp otter	<i>Aonyx congica</i>
Spot-necked otter	<i>Lutra maculicollis</i>
Servaline genet	<i>Genetta servalina</i>
African civet	<i>Civettictis civetta</i>
Leopard	<i>Panthera pardus</i>
Giant pangolin	<i>Smutsia gigantea</i>
Aardvark	<i>Orycteropus afer</i>
Hippopotamus	<i>Hippopotamus amphibius</i>
Red river hog	<i>Potamochoerus porcus</i>
Forest buffalo	<i>Syncerus caffer nanus</i>
Bushbuck	<i>Tragelaphus scriptus (scriptus)</i>
Sitatunga	<i>Tragelaphus spekei gratus</i>
Bush duiker	<i>Sylvicapra grimmia</i>
Blue duiker	<i>Cephalophus monticola</i>
Black-fronted duiker	<i>Cephalophus nigrifrons</i>
Yellow-backed duiker	<i>Cephalophus silvicultor</i>
Bay duiker	<i>Cephalophus dorsalis</i>