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Summary of the proposal to reinforce the reintroduced gorilla population in Gabon

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Introduction

The western gorilla *Gorilla gorilla* is classified as "Critically Endangered" due to past and current rapid population decline (IUCN 2012). The UK-based charity The Aspinall Foundation is committed to the reintroduction of the species to the Batéké Plateau region of the neighbouring Republics of Congo and Gabon, from where the species has been extirpated during the past few decades. This is being undertaken through projects in both range countries in collaboration with the respective national governments. The Congo project was the first to be initiated, and initial post-release results are very encouraging, with released gorillas adapting well to the release site, ranging and behaving in similar ways to wild gorillas, and reproducing successfully (Courage *et al.* 2001; King 2004; King & Courage 2007; King & Chamberlan 2007; King *et al.* 2005, 2006, 2009, 2012; Farmer & Courage 2008).

The Gabon project is ten years younger, but post-release monitoring results are equally encouraging. A comprehensive and fully referenced report concerning the preparations and initial results of the Gabon project to the end of 2007 illustrated that post-release survival was high (85%) and that the two released groups had adapted well to the release site, while in late 2007 the first baby was born within the reintroduced population (Pearson *et al.* 2007). Associated protected area management activities have also been developed, in collaboration with the Gabonese government and the Wildlife Conservation Society (Pearson *et al.* 2007). The full report is available on request from The Aspinall Foundation, and published summaries are also available (Pearson *et al.* 2008; Pearson & King 2008; King *et al.* 2009, 2012). Between 2008 and 2011 the two groups continued to evolve, with a further five births recorded (The Aspinall Foundation, unpubl. data). In 2012, another three births were recorded, and a third group was released (The Aspinall Foundation, unpubl. data).

While the initial results presented by Pearson *et al.* (2007) and King *et al.* (2012) are very encouraging, it is clear that the reintroduced population will benefit from further releases if the goal of re-establishing a viable, self-sustaining population is to be realised. Population modelling based on the quantitative demographic data presented by King *et al.* (2012) predicted that reinforcement of the reintroduced populations could significantly increase the probability of population persistence over 200 years and also increase percentage retention of genetic diversity (King *et al.* in press). Therefore we present here a summary of the full proposal by TAF (2012) for the reinforcement of the current reintroduced western gorilla population in the Batéké Plateau National Park (PNPB) of Gabon, with a group of gorillas currently held in captivity in the UK.

Reintroduction aims and approach

The principal aim of the reintroduction programme, following IUCN (2002) and Beck *et al.* (2007), is to re-establish viable, self-sustaining populations of the western gorilla in the wild, within the former range of the species (PPG 1998, 2003; King *et al.* 2006, 2012; Pearson *et al.* 2007). The programme is considered a true "reintroduction" as defined by Beck *et al.* (2007), as it aims to re-establish the western gorilla "in an area which was once part of its historic range, but from which it has been extirpated or become extinct". The release strategy is "soft", incorporating lengthy phases of pre-release preparation, the release process itself, and post-release support (Pearson *et al.* 2007). The release stock is primarily wild-born, made up of orphans of the national bush-meat trade in Gabon that have been illegally detained in captivity for varying durations from only a few days to several years. The wild-born stock is supplemented by a smaller number of *ex-situ* captive-borns, provided through the captive breeding programme of the Howletts and Port Lympne Wild Animal Parks in UK.

Habitat and release site

The Batéké Plateau National Park (PNPB) was created in 2002, incorporating what was previously the Mpassa gorilla reintroduction site designated in 1998.

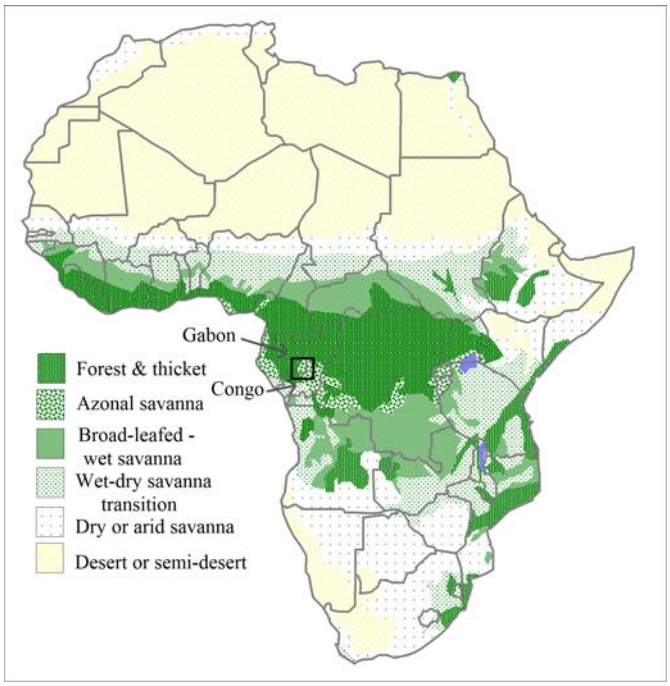

Figure 1. Simplified and generalised distribution of major vegetation types in Africa, adapted from NASA (undated), with the location of the Batéké Plateau National Park indicated by the black square.

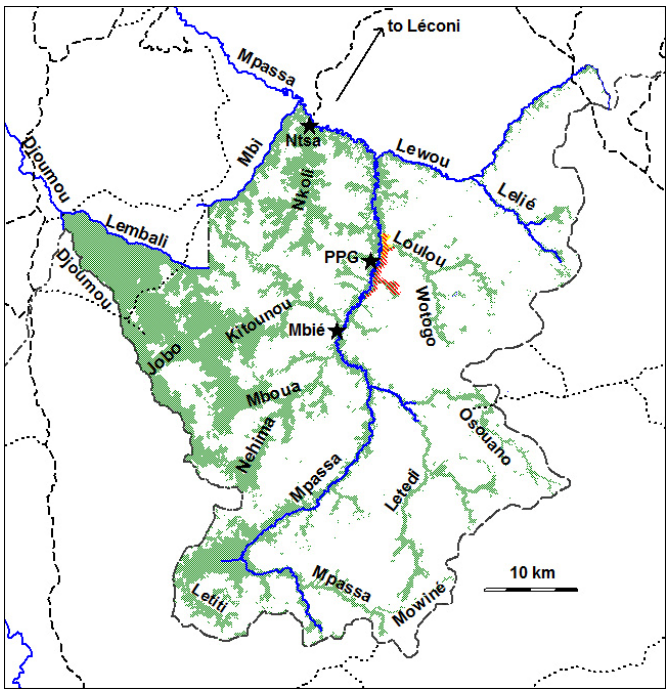

Figure 2. Forest cover, major watercourses and project camps (stars) within the Batéké Plateau National Park, SE Gabon (see Fig. 1), and the home ranges of the first two reintroduced gorilla groups in red (group 1) and yellow (group 2), as of April 2007 (from Pearson *et al.* 2007). The island proposed for the pre-release phase of the group to be transferred from the UK is located 6.5 km south of the Mbié camp.

The PNPB is managed by the National Agency of National Parks (ANPN) of the Gabonese Presidency, in partnership with The Aspinall Foundation and the Wildlife Conservation Society (WCS). As elsewhere on the Batéké Plateau, the PNPB is dominated by rolling grassland, interspersed by gallery forest along the watercourses, and some small forest patches on higher ground. An exception to this is the western portion of the park, which supports the south-eastern limit of the lowland forest block of the Ogooué Basin that covers the majority of the country (Figs. 1-2). In addition to the reintroduced gorillas, the PNPB and surrounding area supports a rich diversity of forest mammals including chimpanzee, elephant, red river hogs, buffalo, leopard, water chevrotain, sitatunga, six species of forest duikers, De Brazza's and moustached monkeys, and talapoin, and also savanna species such as Grimm's duiker, side-striped jackal, and aardvark (Bout 2006; Pearson *et al.* 2007; Bout *et al.* 2010; Wrege *et al.* 2011).

GIS analysis of satellite images illustrated that the PNPB covered a total of 2,044 km² (= 204,400 ha), including 606 km² of forest (= 60,600 ha). Most forest cover is concentrated to the west of the park, while the east of the park is principally savanna with gallery forests along watercourses (Fig. 1). The highest estimated densities of western gorillas reported in the wild are in the region of 5.5 individuals per km², although the majority of studies give densities between 0.5 and 2.5 per km². Therefore a minimum estimate of carrying capacity for the PNPB would be over 300 gorillas (at 0.5 gorillas per km² of forest).

Release stock

The release stock for the PPG-Gabon reintroduction programme consists primarily of wild born orphans of the illegal bush-meat trade in Gabon (King *et al.* 2012). The wild born release stock for the PNPB reintroduction has been supplemented by hand-raised *ex-situ* captive borns from the breeding colony at Howletts & Port Lympne Wild Animal Parks in the UK. Three groups have so far been transferred, in 1999, 2003 and 2008 (PPG 2003; Mahé 2006; Pearson *et al.* 2007; Hopper 2009; Figs. 3-4), totalling 12 individuals aged between 0.5 and 5 years at the time of transfer. Each transfer was conducted within the strict regulations of the Convention on the International Trade in Endangered Species (CITES) framework.

The current proposal is to transfer a fourth group of 11 *ex-situ* captive gorillas from Port Lympne. Several differences distinguish this transfer from the previous three transfers. This will be the first well-established mixed-age family group to be transferred (Fig. 5), incorporating one wild-born 30 year-old adult

Figure 3. The transfer of a group of seven hand-raised gorillas from Howletts and Port Lympne, UK, to the Batéké Plateau National Park, Gabon, in 2003. (Photo: Amos Courage)

Figure 4. Members of the second group of western gorillas released in the PNPB, Gabon, in February 2007, including the captive-borns from Howletts and Port Lympne transferred in 2003. (Photo: Tony King)

Figure 5. The family group proposed for transfer from Port Lympne to Gabon. (Photo: Dave Rolfe)

Figure 6. The adult male, Djala, of the gorilla group proposed for transfer to Gabon, tree-climbing at Port Lympne. (Photo: The Aspinall Foundation)

male (Fig. 6), five captive-born adult females of which all but one were parent-reared, and five captive-born juveniles and infants, all of which were parent-reared and will be accompanying their mothers and father (Table 1). The group stability and the presence of different age classes should allow a strong social cohesion within the group during the different stages of the reintroduction. The diet of the captive group will be modified pre-transfer to resemble more closely their diet in Gabon.

Of the captive group proposed for transfer, the adult male was wild-born but recuperated as an orphan of the bush-meat trade at approximately two years old. The geographic origins of all the group members combined based on EAZA studbook data (Table 2) are Cameroon (57%), Congo (32%) and Gabon (11%). The genetic make-up of the group members originates from four wild males and four wild females. The most represented wild-born individual is the adult male of the group Djala himself, at 32% of the group total, followed by another male, Kisoro, at 17%, and two females Mushie (16%) and Ju Ju (15%) (Table 2). 23% of the genetic diversity is currently unrepresented in the reintroduced population, originating from one male and one female lineage (Mumbah and Mushie). This level of genetic variation will contribute to the heterozygosity of the currently small reintroduced population, but we recognise that further reinforcement may still be necessary in the future.

Disease Risk and Veterinary Requirements

A simplified interpretation of the general health management plan used by PPG in the past as presented by Pearson *et al.* (2007) is given in Table 3. The health management plan for the proposed fourth group will build on these previous experiences, and on other

Table 1. The members of the group proposed for transfer to Gabon. (*Note that Djemba died prior to the transfer, but was included in the original proposal)

Name	Sex	Date of birth	Age Mar 2013	Rearing	Sire	Dam	Transponder
Djala	M	01/01/1982	31.2	unknown	Wild	Wild	960 011 000 003 808
Mumba	F	27/07/1987	25.6	parent	Kijo	Shumba	960 011 000 003 235
Tamki	F	08/10/1989	23.4	hand	Bitam	Killa Killa	956 000 000 853 617
Kibi	F	24/05/1992	20.8	parent	Kijo	Shumba	960 011 000 003 026
Fou Fou	F	10/11/1992	20.3	parent	Kijo	Founda	960 011 000 002 381
Kishi	F	03/08/1998	14.6	parent	Kijo	Mushie	960 011 000 003 759
Mwambe	F	28/08/2006	6.5	parent	Djala	Kishi	960 011 000 003 635
Djongo	M	04/10/2006	6.4	parent	Djala	Kibi	960 011 000 003 356
Louna	M	24/10/2008	4.4	parent	Djala	FouFou	960 011 000 003 908
Akou	F	26/04/2011	1.9	parent	Djala	Kishi	960 011 000 003 399
Djemba*	F	19/02/2012	*	parent	Djala	Mumba	960 011 000 003 087

Table 2. Proportional representation of the wild-born antecedents of each member of the group proposed for transfer to Gabon (Cam = Cameroon; M = male; F = female). (*Note that Djemba died prior to the transfer, but was included in the original proposal)

Wild-born antecedent		Djala	Kisoro	Mumbah	Bitam	Mushie	Ju Ju	Founda	Mouilou
Origin		Congo	Cam	Cam	Gabon	Cam	Cam	Gabon	Cam
Sex		M	M	M	M	F	F	F	F
Djala	M	1							
Mumba	F		0.25	0.25		0.25	0.25		
Tamki	F		0.25		0.5				0.25
Kibi	F		0.25	0.25		0.25	0.25		
Fou Fou	F		0.25				0.25	0.5	
Kishi	F		0.25			0.5	0.25		
Mwambe	F	0.5	0.125			0.25	0.125		
Djongo	M	0.5	0.125	0.125		0.125	0.125		
Louna	M	0.5	0.125				0.125	0.25	
Akou	F	0.5	0.125			0.25	0.125		
Djemba*	F	0.5	0.125	0.125		0.125	0.125		
Total	11	3.5	1.875	0.75	0.5	1.75	1.625	0.75	0.25
%	100	32	17	7	5	16	15	7	2

resources such as the Veterinary Healthcare Manual of PASA (2004). All individuals of the captive group will be disease-screened in UK prior to transfer according to a risk assessment, following IUCN guidelines as detailed in TAF (2012). They will undergo a pre-transfer quarantine in UK, then transported to the quarantine area within the PNPB for their post-transfer quarantine phase. Their vaccination schedule will be started pre-transfer.

The medical monitoring of the group will include regular stool sampling on site for internal parasites, and occasional blood draws for analysis by CIRMF in Franceville when necessary and feasible. Staff working with individuals during quarantine will not work with the released groups. The gorillas will be vaccinated for Polio and Tetanus, and Measles. They will also be vaccinated for Rabies (for transit through France). They will be given a malaria prophylaxis

Table 3. Simplified and generalised summary of past PPG health management plans from Pearson *et al.* 2007 (Significance to apes or staff is a subjective combined assessment of severity, probability and ease of testing and treatment: H = high, M = medium and L = lower).

Disease	Significance		PPG management plan
	Apes	Staff	
Ebola/Marburg	H	H	mortality so high and rapid that living apes highly unlikely to have been exposed, plus collaboration with CIRMF and WCS for awareness and testing
Tuberculosis	H	H	test apes during quarantine and pre-release, isolate positive apes; test and treat or vaccinate staff; refuse access by positive or untested humans (eg local populations, visitors)
EMCV	M	L	pest control & disinfection of stored foods before feeding to apes
Anthrax *Bacillus anthracis*	M	M	isolation of apes showing clinical signs during quarantine, smears from suspicious carcass found in the forest
Malaria	M	H	preventative testing; preventative medication (malarone) for *ex-situ* release stock; free treatment of clinical signs for staff; preventative medication advised for short-term overseas visitors
Filariosis	M	H	preventative testing, treatment of clinical signs for staff and apes
Streptococcus pneumoniae	L	L	quarantine affected animals
Measles	H	H	vaccination of staff (and apes at PPG Congo)
Mumps	L	H	vaccination of staff (and apes at PPG Congo)
Rubella	L	L	vaccination of staff (and apes at PPG Congo)
Diptheria	L	L	vaccination of apes and staff
Tetanus	M	H	vaccination of apes and staff
Polio	H	H	vaccination of apes and staff
Rabies	M	L	vaccination of apes from UK if transiting through Europe
HIV/SIV	M	H	test apes during quarantine, and staff regularly; refuse direct contact between positive staff and apes (for the well being of the staff)
HTLV/STLV	L	L	test apes and staff if possible
Hepatitis A	L	H	test apes; vaccination of staff
Hepatitis B	L	H	test apes & staff; vaccination of staff
Hepatitis C	L	M	
Herpes simplex	L	M	
RSV	L	L	
Yellow fever	L	M	vaccination of staff
Adenovirus	L	L	
Influenza orthomyxovirus	M	M	
Shigellosis	H	M	test apes & staff during quarantine (if possible)
Salmonellosis (typed)	H	M	test apes & staff during quarantine (if possible)
Camplyobacter spp.	H	M	test apes & staff during quarantine (if possible)
Enteropathogenic *E. coli*	M	M	test if symptoms
Yersinia sp.	M	M	test if symptoms
Klebsiella sp.	M	M	test if symptoms
Oesophagostomum	H	M	daily disinfection of cage floor; regular stool testing of apes; treatment of entire group if one positive result (pre-release); hygiene rules for staff
Ankylostomiasis	M	M	regular stool testing of staff and apes; treatment if positive result; hygiene rules for staff
Strongyloidiasis / Anguillules	M	M	regular stool testing of staff and apes; ; treatment of entire group if one positive result (pre-release); hygiene rules for staff

Ascaris	M	M	regular stool testing of apes; treatment of entire group if one positive result (pre-release); hygiene rules for staff
Whipworm *Trichuris*	M	M	regular stool testing of staff and apes; treatment if positive result; hygiene rules for staff
Hydatids/ *Taenia*	L	L	regular stool testing; treatment if positive result; pest control
Pinworm *Enterobius*	M	M	regular stool testing of staff and apes; treatment if positive result; hygiene rules for staff
Balantidium coli	M	M	regular stool testing of staff and apes; treat if heavy load or symptomatic
Entamoeba hystolytica	M	M	regular stool testing of apes and staff; treatment of group when symptomatic; hygiene rules for staff
Giardia intestinalis	M	M	regular stool testing of staff and apes; treat if heavy load or symptomatic
Cryptosporidium	M	M	regular stool testing of staff and apes; treat
Candidiasis	M	L	antifungal treatment to accompany antibiotic treatments in weak apes, especially during quarantine
Sarcoptes spp. (scabies)	M	L	treat apes and staff; avoid spread as very difficult to eradicate once established in a large group

treatment, using atovaquone/proguanil (malarone®), as this was a possible significant difference between the health of the first and second groups transferred (see Pearson *et al.* 2007). They will be given vitamin supplements as post-transfer support, for approximately one year depending on feasibility. Deworming of all individuals will be undertaken pre- and post-transfer to the PNPB. Strict hygiene protocols will be enforced to reduce risk of parasite spread. Initial post-transfer deworming will be administrated systematically, possibly every 4-5 weeks. The interval between treatments will then be progressively increased to avoid creating resistance or limiting the gorillas from building their own immunity. Results of regular stool exams will guide further treatments. In addition, gorillas will be shown food-plant species in the PNPB that can be used as self-medication against intestinal worms, such as *Aspilia* and *Vernonia* spp.

Transport

The gorilla group will be accompanied during the transfer from UK to Gabon by well-known humans, including a veterinarian and a Port Lympne keeper. The gorillas will be anaesthetised for placement in the transport crates, but will be fully conscious throughout the journey. They may be given a mild oral sedative (diazepam) if they appear overly excited or during particularly stressful periods. On arrival in Gabon, the crates will be transferred rapidly to the PNPB. After a short boat crossing, the crates will be opened on the pre-release island in an area prepared appropriately. The transfer is proposed to occur during the dry (and cool) season to facilitate logistics, and to reduce the risks of immediate parasite infection or heat stress.

Pre-Release Preparation and Soft-Release Process

All gorillas that enter the reintroduction programme undertake a lengthy period of preparation prior to final release, following methods refined through years of experience at PPG - see Pearson *et al.* (2007) for definitions of phases involved. The current proposed group for release differs from previous groups in being a mature, mixed-age family group, including an adult male and several adult females. Therefore the process of pre-release preparation and soft-release will be modified from that of previous groups.

The pre-release preparation phase will be undertaken on an island near the southern limit of the home ranges of the two groups already reintroduced (Fig. 2), so that the habitat on the island resembles that of the release site (Fig. 7). The group will therefore be isolated from other great apes in the area during the pre-release phase, thereby avoiding disease transmission possibilities, and providing the group with a calm area for getting to know the local habitats and food plants of the reintroduction site, whilst also allowing visual and auditive contact with the groups already reintroduced.

A preliminary survey in 2007 made the following observations (King 2007): “the island is 3.5 ha in size, of which approximately 1 ha is forest and the rest is open shrubby vegetation dominated by *Aframomum*, grasses, sedges, Melastomataceae spp. and other low hydrophilic shrubs, plus numerous small *Harungana madagascariensis* and the occasional ‘tree’ such as *Alstonia boonei*, *Mitragyna stipulosa* and *Raphia* sp. The north-western third of the island is forested, dominated by the swamp-tolerant *Xylopia* sp. but there is a small patch of fairly dry forest in the western portion of the island which is a little more diverse, and

Figure 7. The forested north-west part of the 3.5 ha island in the Batéké Plateau National Park proposed for the pre-release phase for the group of gorillas to be transferred from the UK. (Photo: Tony King)

Figure 8. The narrow channel along the southern part of the proposed pre-release island. (Photo: Tony King)

is occasionally visited by elephants (Fig. 2). The fruits of *Xylopia* could provide a seasonal food source for gorillas, and there are a few individuals of other fruit-providing species present, such as *Landolphia* sp. The understorey is generally poor with only a few stands of *Sarcophrynium* sp. (Marantaceae), plus the occasional *Palisota* sp. (Commelinaceae), *Eremospatha* sp. and/or *Ancistrophyllum* sp. (Palmae), *Culcasia* sp. (Araceae) and *Dioscorea* spp. (Dioscoreaceae). However, this lack of browse in the forest understorey is made up to some extent by the relatively extensive areas of *Aframomum* elsewhere on the island."

The southern channel is fairly thin and shallow (Fig. 8), so will need to be regularly monitored during the pre-release phase to ensure the gorillas remain on the island. The island's small size and lack of significant food sources means that the gorillas held on the island will need a significant amount of supplementary food to be provided by project staff on a daily basis. The staff will be based at a project camp located 1 km from the island. Three feeding platforms will be built on the west side of the island, each with a protective "paroir" to prevent contact between the gorillas and the staff. A mirador will also be constructed on the west bank of the Mpassa river opposite the feeding platforms, to allow assessment of behavioural, psychological and health aspects of each individual. Medical interventions may be conducted as necessary, depending on feasibility. Supplementary feeding will be necessary throughout the pre-release phase. Local foods will be collected for the supplementary feeding, but also more familiar foods available from local markets will be provided, at least initially, as well as croquettes used by many zoos to feed captive gorillas.

After a minimum of two months, project staff will determine when the group appears ready for transfer to the release site. A bridge, prepared in advance, will allow the gorillas to cross the narrow channel separating the island from the east bank of the Mpassa river. The bridge will remain in place post-release, allowing the gorillas to return to the island for supplementary feeding provided as post-release support, and to try to prevent major displacements immediately following release. Feeding will be reduced gradually with time, depending on the circumstances.

Post-release Monitoring

Post-release monitoring will be facilitated by the existence of an extensive trail system within the release site, with each trail named and features marked at regular intervals to allow precise description of locations. We hope to fit the dominant male with an ankle bracelet containing a radio tracking transmitter to facilitate monitoring. The bracelet design is being developed during trials at Port Lympne.

Monitoring post-release will be undertaken daily for the first year post-release, then reduced gradually over many months. Daily locations will be deduced from direct or indirect observations, radio-tracking, and/or camera-trapping. For each direct observation, group members observed, visual health indicators, general behavioural observations, and food-plant utilisation will be noted. Staff observations will be noted on daily record sheets, and locations plotted in a geo-referenced database. Post-release veterinary intervention may be justifiable when possible and if deemed necessary.

Conclusions

Given the long life-histories of gorillas, we recognise that the western gorilla reintroduction project within the PNPB, Gabon, is still young, but the initial results are very encouraging, and it is clear that the population will benefit from the addition of further release stock. This proposed release of a new group will help bring the project closer to realising the long-term goal of re-establishing a viable, self-sustaining population in the area.

Our proposal to try for the first time to reintroduce a mature, mixed-age family group, has numerous implications for the potential to more rapidly establish viable populations. Both the Congo and Gabon gorilla reintroduction projects have so far been restricted by the availability of release stock in-country, especially since the considerable reduction in the numbers of gorilla bush-meat orphans being reported and confiscated since the creation of the PPG projects in both countries (King *et al.* 2009, 2012). The Gabon project has already pioneered the addition of young hand-reared captive-born gorillas to the potential release stock, the current proposal goes further in attempting to release a mature group of primarily parent-reared gorillas. If successful this will have the advantage over previous methods of releasing gorillas that have spent all or most of their lives in a gorilla society, following gorilla society rules, and hopefully will reduce the need for lengthy procedures to "dishabituate" hand-reared gorillas from human presence. The logistical issues involved in the transport and release of a mature group may be more challenging, but if successful the longer-term reintroduction objectives could be more rapidly and effectively realised.

Although the primary objective of the project is the reintroduction of the western gorilla, the project also has several secondary objectives and/or benefits (King *et al.* 2012). For example, the release site itself has benefited from the project, through the creation of the Batéké Plateau National Park, and the associated resource management activities through collaboration between The Aspinall Foundation, the Wildlife Conservation Society, and the Government of Gabon. Although difficult to measure, the re-establishment of a gorilla population in the PNPB should also have positive impacts on the ecological dynamics of the forest, given the important role they have been shown to play in forests elsewhere in Gabon.

At an international level, the reintroduction programme has proved to be attractive to the popular media, generating global publicity for the plight of the gorilla, and of the national conservation strategy implemented in Gabon. The transfer of captive-born gorillas from UK has been particularly well covered by international media, with two television series and numerous newspapers and magazines following the transfer and progress of the gorillas 'sent home'. Similar national media coverage in Gabon can help generating national pride concerning the gorilla, and will be a further contribution to the overall effort to save the species in the wild for future generations.

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