The rules and the reality of mountain gorilla *Gorilla beringei beringei* tracking: how close do tourists get?

Chris Sandbrook and Stuart Semple

Abstract Mountain gorilla *Gorilla beringei beringei* tracking tourism generates important revenue for conservation efforts but brings with it the threat of disease transmission into the gorilla population. This study quantifies for the first time aspects of encounters between gorillas and tourists at Bwindi Impenetrable National Park that are likely to contribute to the risk of disease transmission. These include how close tourists get to gorillas, how close encounters are initiated, how long they last, and the age class of gorillas involved. Tourists got significantly closer to gorillas than the park rules allow (a mean of 2.76 m, compared to the rule of 7 m), and remained close for long periods. Contacts with the gorillas most vulnerable to disease, the juveniles, were closer but of shorter duration than those with adults. Contacts initiated by gorillas were closer but shorter than those initiated by tourists. Taken together these results demonstrate that the present rules are failing, and that the risk of disease transmission may be greater than previously believed.

Keywords Bwindi Impenetrable National Park, ecotourism, *Gorilla beringei beringei*, impact management, Uganda, zoonosis.

Introduction

The tracking of mountain gorillas *Gorilla beringei beringei* in their remaining forest habitat in Uganda is a high value activity that generates enough revenue to cover park management costs and contribute to the national budget of the Uganda Wildlife Authority (Archabald & Naughton-Treves, 2001). As a result tourism is generally considered a crucial component of gorilla conservation strategy (Weber, 1993; McNeilage, 1996). There are however several concerns about the effectiveness of tourism as a conservation tool in this context (Butynski & Kalina, 1998), foremost amongst which is the risk of diseases being transmitted to gorillas. An event of this kind could have devastating consequences for this Critically Endangered species (Homsy, 1999; Daszak *et al.*, 2000; IUCN, 2006).

Whereas gorillas are perhaps most at risk from catching diseases from park staff, researchers, and local people living in their habitat (Wallis & Lee, 1999; Guerrera *et al.*, 2003), tourists also pose a significant threat because (1) there is a high level of exposure to tourists as habituated gorilla groups experience close contacts with a group of tourists every day, (2) tourists may bring with them novel infections to which the gorillas have no immune response and (3) it has been found that some tourists visiting chimpanzees in Uganda show symptoms of risk diseases such as diarrhoea, coughing and respiratory distress (Adams *et al.*, 2001). Gorillas can be vulnerable to human gut and skin parasites (Sleeman *et al.*, 2000; Kalema-Zikusoka *et al.*, 2002) but airborne diseases are believed to represent the greatest threat posed by tourists (Homsy, 1999). Examples of suspected airborne disease transmission events between humans and great apes in the wild include an influenza-like outbreak in wild chimpanzees (Kortland, 1996), and a measles-like outbreak in the mountain gorillas of Parc National des Volcans, Rwanda, in which six individuals died (Sholley, 1989).

The degree of health threat posed by tourists depends on a number of factors: whether any tourist is infected with a risk disease and, if so, the infectiousness and mode of transmission of that disease (Woodford *et al.*, 2002); how close tourists get to the gorillas, as the risk of infection with diseases transmitted by air increases with increasing proximity (Homsy, 1999); the number of tourists in the group and the duration of their visit, as the risk of transmission is linked to exposure to infectious individuals; the characteristics of the gorillas that come into close contact with humans, as juvenile gorillas are considered more vulnerable to human diseases than adults (Graczyk *et al.*, 2001) and are more curious and likely to approach humans (A. McNeilage, pers. comm.).

Chris Sandbrook (Corresponding author) Institute of Zoology, Regent's Park, London, NW1 4RY, UK. E-mail chris.sandbrook@ioz.ac.uk

Stuart Semple School of Human and Life Sciences, Roehampton University, London, SW15 4JD, UK.

Received 23 June 2005. Revision requested 29 September 2005. Accepted 4 January 2006.

Taking these risk factors into account, tourists are expected to abide by a number of rules during their visits to gorillas (for full details of all tracking rules see IGCP, 2005): (1) if they feel unwell tourists must declare themselves sick and not enter the forest; (2) a rule on the minimum distance that tourists must keep from the gorillas is applied, and this was recently extended from 5 to 7 m in Uganda following the publication of a report into gorilla tracking rules (Homsy, 1999) citing evidence that particles from a human sneeze can travel up to 6 m in still conditions (Baker, 1995); (3) tourists defecating in the park are required to bury their faeces; (4) tourist visits are limited to a maximum of 1 hour with the gorillas and the number of visitors in each group is controlled (this number was six at the time of fieldwork for this study, but has since been increased to eight).

Successfully enforcing gorilla tracking rules is difficult because of gorilla and tourist behaviour, and because guides may allow rules to be broken in pursuit of tips or as a result of accepting bribes (McNeilage, 1996; Butynski & Kalina, 1998). Infringements of gorilla tracking rules have been widely reported (Aveling, 1991; McNeilage, 1996) but to date there has been no study that sets out to quantify them systematically. This information is urgently required to allow a more complete evaluation of the risks associated with gorilla tourism. The study described here meets this need by measuring how close tourists get to gorillas, how these close contacts are initiated, the age class of gorillas with which close contacts occur, and the duration of contacts. The results demonstrate dramatic failings in the enforcement of current tracking rules.

Methods

Study site and sampling strategy

Data were collected between February and December 2004 in Mukono parish, home to the headquarters of Uganda's Bwindi Impenetrable National Park (Fig. 1). Three gorilla groups have been habituated for tourist visits at this site and each could receive one group of up to six tourists per day at the time of the study, giving a daily maximum of 18 tourists tracking gorillas. Tourists attended a Uganda Wildlife Authority briefing session in the morning before tracking, at which they were greeted by CS, introduced to the research project, and asked if they would be willing to be interviewed. Those accepting were visited for interview in the afternoon following their return from the forest. Tourists were

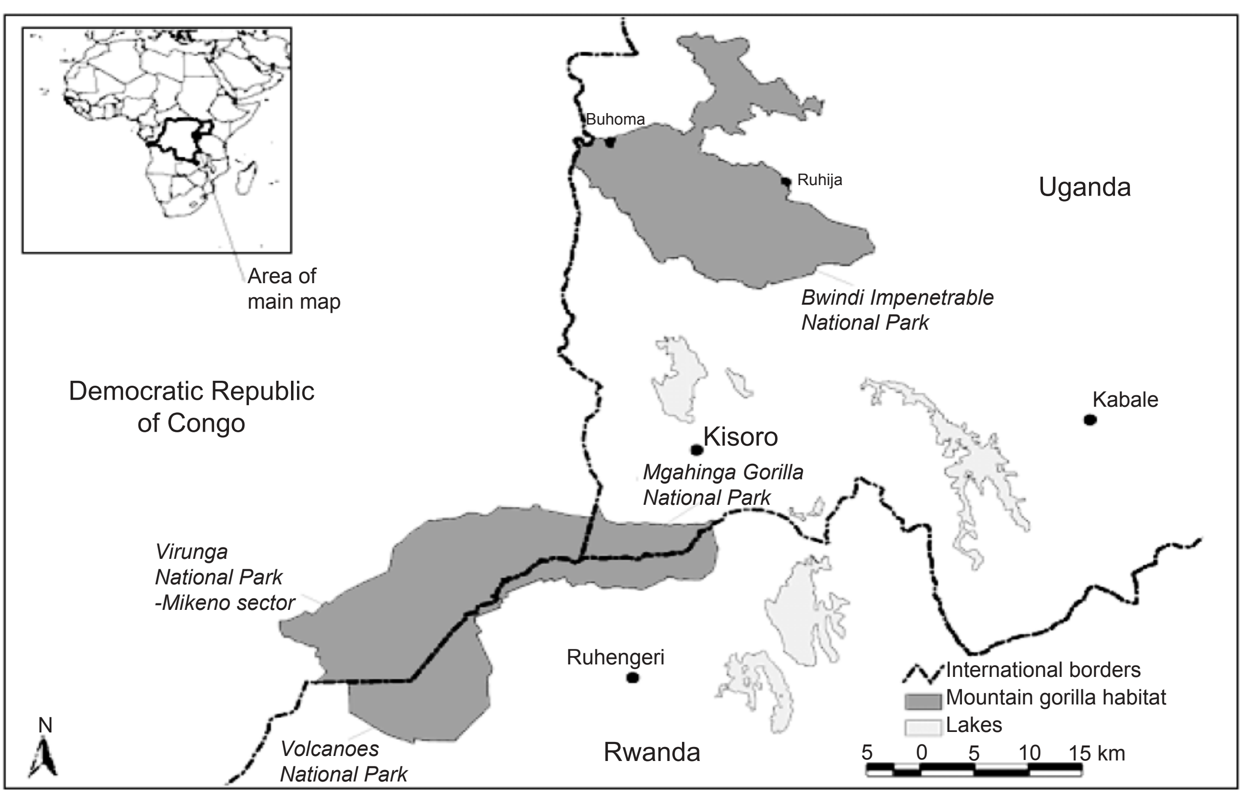

Fig. 1 Map showing the mountain gorilla parks of Central Africa (provided by IGCP, 2005). Fieldwork was carried out in Buhoma village on the north-west side of Bwindi Impenetrable National Park.

sampled opportunistically on the basis of availability, with as many individuals as possible interviewed each day. No individual declined to participate in the study.

Data collection

In each interview the purpose of the study was explained and the participant taken through a structured questionnaire that provided data regarding their visit to the gorillas. These were how close they got to the gorillas at the point of closest contact, how long this contact lasted, the age category (juvenile or adult) of the gorilla involved if known, the contact initiator (tourist or gorilla), and the typical distance from themselves to gorillas during the visit, defined as the closest distance tourists maintained to gorillas for at least 15 cumulative minutes during the hour (to give a measure of general encounter proximity ignoring passing close encounters of short duration). Distances were estimated using a tape measure, with respondents asked to hold one end of the measure while the interviewer backed away from them until the respondent felt the appropriate distance had been reached. Duration was estimated by tourists in seconds. These techniques are simple and repeatable, and give data indicative of the true situation without requiring additional researchers in the forest. Respondents were not asked about the sex of gorillas as they were unable to identify this accurately in a pilot study. The contact initiator and gorilla age class were determined by the tourists themselves. Tourists were also asked which group they had tracked, who the guide was, and how much money they gave to the guide as a tip. All interviews were carried out in English by CS.

Data analysis

Data for tourists who tracked the same gorilla group on the same day were pooled to avoid pseudo-replication, with mean values for each independent tourist group (all those visiting one gorilla group on 1 day) being used for analysis. The actual proximity of tourists to gorillas was compared with the allowable proximity under the tracking rules (7 m) using a *t*-test. Differences in mean proximity were compared across tour guides by analysis of variance. The relationship between tips received by guides and contact proximity was examined using Pearson's correlation. To test for the effects of contact initiator and the age category of gorilla contacted on closest proximity and contact duration, linear mixed effects models (LMEs) were constructed. LMEs make explicit the effect structure in the data and take account of pseudo-replication, meaning that all tourist data could be used in these analyses without any need for pooling. In these models, contact initiator (tourist or gorilla) and gorilla age category (juvenile or adult) were used as fixed effects, and gorilla group and tourist group were used as random effects, with the latter nested in the former. Data for second and subsequent visits to gorillas made by tourists who saw the gorillas on more than 1 day were discarded to reduce the complexity of the effect structure in the model. The response variables were log transformed to meet the model assumption of normality. Initially both fixed effect terms and their interaction were included in the proximity model (Model I, Akaike Information Criterion, AIC = 528.336). However, the interaction term was not significant ($t_{232} = -0.290$, $P = 0.772$) and therefore it was discarded. The resulting simplified model was found to explain the data better (Model II, AIC = 524.256) and was preferred for further analysis. The same process was carried out for the duration model, with the best model having no interaction term (Model III, AIC = 1395.760). LME analyses were carried out using *R 2.0.1* (R Development Core Team, 2004) and for all other analyses *SPSS 10.1.3* was used.

Results

How close do tourists get to gorillas?

A total of 361 tourists were interviewed, representing 133 independent tourist tracking groups. While no events of physical touching were reported, the mean

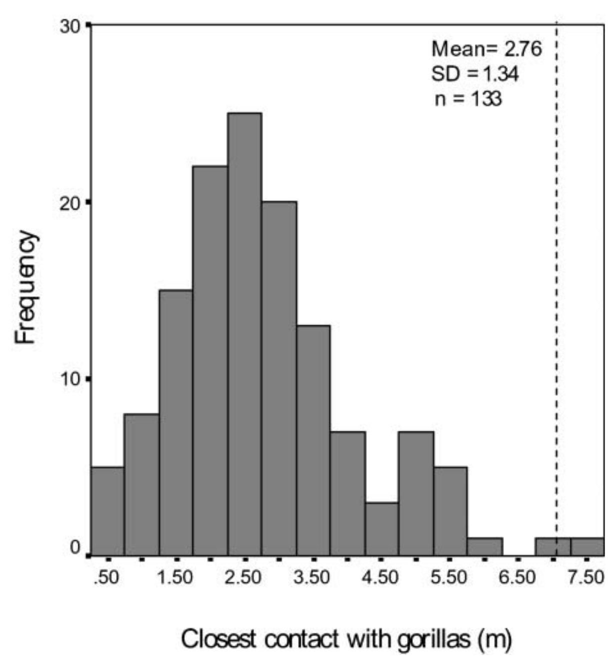

Fig. 2 The frequency and proximity of closest contacts with gorillas for each independent tourist group. The dashed line represents the 7 m rule for closest allowable proximity during tracking.

Table 1 Parameters of LME Model II using log closest contact as the response variable, contact initiator and gorilla age class as fixed effects and gorilla group and tourist group as random effects, of which the latter is nested in the former. Gorilla age class was categorized as juvenile or adult, and contact initiator was categorized as tourist or gorilla.

Predictor	Coefficient	SE	df	*t*	P
Intercept	0.573	0.089	233	6.465	<0.001
Age class	0.244	0.068	233	3.597	<0.001
Contact initiator	0.214	0.059	233	3.607	<0.001

Table 2 Estimates from Model II of closest contact proximity (m) between tourists and gorillas under each combination of factor levels.

	Contact initiator	
Age category	Gorilla	Tourist
Juvenile	2.805	3.475
Adult	3.578	4.433

distance between tourists and gorillas at the time of their closest contact was 2.76 ± SD 1.34 m. This is significantly closer than permitted under the current rule of 7 m ($t_{132} = -36.54$, $P < 0.001$; Fig. 2). The mean closest distance between tourists and gorillas maintained for at least 15 minutes during the tracking hour was 4.85 ± SD 2.01 m, which again is significantly closer than the minimum allowable ($t_{131} = -12.272$, $P < 0.001$).

How do closest contacts occur?

The model best explaining the data (Model II) showed that both contact initiator ($t_{233} = 3.607$, $P < 0.001$) and age class of gorilla contacted ($t_{233} = 3.597$, $P < 0.001$) were significant factors related to the proximity of closest contacts (Table 1). Contacts initiated by gorillas were closer than those initiated by tourists, and contacts with juvenile gorillas closer than contacts with adults (Table 2).

How long do closest contacts last?

There was a strong positive correlation between closest contact distance and duration ($r = 0.352$, $P < 0.001$, n = 133). Model III, identical to Model II but using log duration instead of log proximity as the response variable, showed that both contact initiator ($t_{233} = 0.852$, $P < 0.001$) and age class of gorilla contacted ($t_{233} = 3.961$, $P < 0.001$) were significant factors determining contact duration (Table 3). Contacts with adults lasted longer than with juveniles, and contacts initiated by gorillas were shorter than those initiated by tourists (Table 4).

The role of guides and tips

There was no significant variation in closest contact proximity across guides (ANOVA $F_{12,110} = 1.321$, $P = 0.217$). There was no significant correlation between tips given and closest contact proximity (Pearson's correlation; $r = 0.122$, $P = 0.166$, n = 131).

Discussion

A previous study of primate tourism in Uganda demonstrated that humans visiting great apes are potential sources of infection (Adams *et al.*, 2001), but did not investigate how close tourists get to these animals, a variable linked to the risk of a disease being transmitted (Woodford *et al.*, 2002). The results of this study address this issue, and show that in the case of mountain gorillas in Bwindi Impenetrable National Park, tourists get extremely close. The minimum distance rule of 7 m was broken on a daily basis, and contacts with juveniles were closer than with adults. The mean closest distance maintained for at least 15 minutes was significantly less than 7 m, indicating that encounters were not fleeting. These results demonstrate serious problems with the present rules, and that the risk of disease transmission may be greater than previously believed.

Table 3 Parameters of LME Model III using log closest contact duration as the response variable, contact initiator and gorilla age class as fixed effects and gorilla group and tourist group as random effects, of which the latter is nested in the former. Gorilla age class was categorized as juvenile or adult, and contact initiator was categorized as tourist or gorilla.

Predictor	Coefficient	SE	df	*t*	P
Intercept	3.458	0.245	233	14.139	<0.001
Age class	0.904	0.228	233	3.961	<0.001
Contact initiator	1.776	0.201	233	8.852	<0.001

Table 4 Estimates from Model II of closest contact duration (s) between tourists and gorillas under each combination of factor levels

	Contact initiator	
Age category	Gorilla	Tourist
Juvenile	463.275	2,737.373
Adult	1,143.736	6,758.039

There are several factors that help to explain why tourists get so close to gorillas. Firstly, it has been suggested that excessively close encounters occur because gorillas are over-habituated and actually approach tourists, particularly in the case of inquisitive juvenile animals (Graczyk *et al.*, 2001; Mudakikwa *et al.*, 2001). This hypothesis is supported by the results of this study, because contacts initiated by gorillas were closer than those initiated by tourists, and contacts with juvenile individuals were closer than those with adults. Secondly, Bwindi Impenetrable Forest is dense, often making it impossible to get a clear view of the gorillas from 7 m away. This places guides under pressure to allow tourists to get closer so that they can see the gorillas clearly. The dense foliage and steep topography also make it difficult to retreat should a gorilla approach the group, and this limits guides' ability to move their visitors back. This problem is likely to be exacerbated by the recent increase in the number of tourists allowed per group from six to eight. Thirdly, the gorillas within each group are often dispersed over a wide area, and tourists can find themselves surrounded by them, making it impossible to move away.

These constraints on guides' ability to prevent tourists getting too close to gorillas suggest that in some situations it is impossible to stop excessively close encounters from occurring but cannot fully explain the results of this study. Although the closest encounters were initiated by gorillas, those initiated by tourists were still far closer than the allowable distance and lasted long enough to suggest that these were not accidental fleeting encounters. One tourist reported being <1 m from a gorilla for 10 minutes, an encounter both avoidable and unacceptable. In the defence of guides, no evidence was found for performance differences between them or for a link between contact proximity and their tips. These findings are contrary to the expectations of some previous authors (McNeilage, 1996; Butynski & Kalina, 1998), suggesting that either the bribery hypothesis is incorrect and the guides are honest, or that there is a more complex relationship between tips and guide performance. Alternatively, guides may be unable to judge how far 7 m is as a result of poor training.

The results of this study demonstrate that at present the rules governing how closely tourists can approach gorillas at Bwindi Impenetrable National Park are failing, with the 7 m rule clearly not enforced. Even this distance may be dangerous as it is based on research into sneezing and is not a scientifically determined safe distance for gorilla viewing (Baker, 1995; Homsy, 1999). Changing this rule seems unlikely to help, as reducing or removing the minimum distance would suggest tourists could go closer, and increasing it would make it even less enforceable. Training of guides should be improved, but it seems inevitable that close encounters will go on occurring for as long as tourists are allowed to visit wild mountain gorillas. It may therefore be wise to consider adopting other measures for the reduction of disease transmission risk, such as surgical masks for tourists during their time with the gorillas (Adams *et al.*, 2001) or medical screening and explicit vaccination requirements to reduce the chance of infectious tourists tracking gorillas (Homsy, 1999). These possibilities now require urgent consideration because if action is not taken there is a risk that the tourists who believe they are supporting gorilla conservation will unwittingly contribute to their further decline.

Acknowledgments

We thank the Uganda National Council for Science and Technology and Uganda Wildlife Authority for permission to carry out fieldwork at Bwindi Impenetrable National Park, three anonymous reviewers for helpful comments, and all those who assisted with fieldwork. This research was funded with a PhD studentship from the UK Economic and Social Research Council and the Natural Environment Research Council.

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Biographical sketches

Chris Sandbrook's research focuses on the impacts of tourism on protected areas and local people living around them.

Stuart Semple's research interests include primate conservation and welfare.