



Impacts of tourism on anxiety and physiological stress levels in wild male Barbary macaques

Laëtitia Maréchal^{a,*}, Stuart Semple^a, Bonaventura Majolo^b, Mohamed Qarro^c, Michael Heistermann^d, Ann MacLarnon^a

^a Centre for Research in Evolutionary Anthropology, Roehampton University, Holybourne Avenue, London SW15 4JD, UK

^b School of Psychology, University of Lincoln, Brayford Pool, Lincoln LN6 7TS, UK

^c École Nationale Forestière d'Ingénieurs, Avenue Moulay Youssef, BP 511, Tabriquet, 1100 Salé, Morocco

^d Reproductive Biology Unit, German Primate Center, Kellnerweg 4, D37077 Göttingen, Germany

ARTICLE INFO

Article history:

Received 8 March 2011

Received in revised form 17 May 2011

Accepted 19 May 2011

Available online 12 June 2011

Keywords:

Tourism

Impact

Interaction

Macaca sylvanus

Anxiety

Stress

ABSTRACT

Wildlife tourism is a burgeoning global industry with the potential to make a significant contribution to the conservation of endangered species. However, a number of studies have provided evidence that tourists' presence and behaviour may impact negatively on the animals involved, with potentially harmful consequences for their health, reproduction and population viability. Here, we investigate impacts of tourism on wild male Barbary macaques (*Macaca sylvanus*) in Morocco, quantifying a behavioural index of animals' anxiety (self-scratching) and a measure of their physiological stress levels (faecal glucocorticoid concentrations – FGCs). Four measures of tourist presence, number or proximity were explored: maximum number, percentage of time present, mean number while present, and closest proximity to the macaques. In addition, rates of three types of interactions between tourists and macaques – neutral (e.g. photographing), feeding and aggressive – were quantified. Males' rates of self-scratching were positively related to the mean number of tourists present and to rates of all three human-macaque interactions, but were unrelated to the other three measures of tourist pressure. FGCs were positively related to rates of aggressive interactions between humans and macaques, but unrelated to any of the other six measures of tourist pressure. These findings suggest that while tourist presence and interactions (even apparently innocuous ones) with the macaques elevate the study animals' anxiety levels, only aggressive interactions are sufficient to elicit a detectable increase in our measure of physiological stress. These results can be used to inform management of tourism both at this site, and at other locations where tourists view and can interact with wild primates.

Crown Copyright © 2011 Published by Elsevier Ltd. All rights reserved.

1. Introduction

Wildlife tourism is a large – and rapidly growing – industry, and one that has the potential to make a very significant contribution to the conservation of biodiversity (Newsome et al., 2005; Fennell, 2008). However, concerns remain about the possible impacts of tourists on the animals that they have come to see (Rodger and Calver, 2005). Until quite recently, such impacts were typically explored in terms of behavioural changes brought about by the presence or behaviour of tourists. For example, Asian rhinoceros (*Rhinoceros unicornis*) showed increased vigilance time and decreased feeding when tourists were present (Lott and McCoy, 1995), and black howler monkeys (*Alouatta pigra*) exposed to tour-

ists tended to move higher into the canopy (Treves and Brandon, 2005). Changes in animals' behaviour linked to interactions between tourists and animals have also been explored. Mann and Smuts (1999), for example, found that tourists' interactions with dolphins can change the latter's foraging behaviour and also reduce levels of maternal care. While such studies have been valuable in highlighting how tourism can change patterns of behaviour, determining whether such changes are detrimental has proved difficult; for this, more direct measures are needed.

The development of non-invasive techniques for quantification of levels of stress hormones has recently allowed researchers to investigate how exposure to tourism may impact on the physiological stress levels of wild animals (Busch and Hayward, 2009). Assessment of faecal glucocorticoid concentrations (FGCs) is particularly useful in this respect as faecal samples are easy to collect with minimal disturbance to the animal, and there is evidence that FGCs reliably reflect free cortisol levels in blood (Sheriff et al., 2010). Barja et al. (2007) found that FGCs among European pine

* Corresponding author. Address: Centre for Research in Evolutionary Anthropology, Whitelands College, Roehampton University, Holybourne Avenue, London SW15 4JD, UK. Tel.: +44 208 392 3473; fax: +44 208 392 3529.

E-mail address: marechal11@roehampton.ac.uk (L. Maréchal).

martens (*Martes martes*) were positively related to the number of tourists in the area. Working with black howler monkeys (*A. pigra*), Behie et al. (2010) found that groups exposed to tourism showed higher FGC levels than groups not visited by tourists. As elevated stress levels due to tourism can impact negatively on animal health, reproductive success and survival (Romero and Wikelski, 2001; Ellenberg et al., 2007; French et al., 2010), and thus have consequences at the population level (Charbonnel et al., 2008), such effects are of clear conservation concern. Further studies of wildlife tourism impacts on stress, and in particular studies identifying causal factors in this relationship, are therefore necessary (Busch and Hayward, 2009).

While studies quantifying stress hormone levels have provided insights into the impacts of wildlife tourism, such approaches do not allow identification of factors that impact negatively on animals, but that are not in themselves sufficient to elicit a glucocorticoid output in response to the potential stressor. A powerful tool to explore impacts of this kind is the quantification of variation in rates of self-directed behaviours (SDBs), such as self-scratching. There is strong evidence that such behaviours provide an index of anxiety (Maestripietri et al., 1992). In pharmacological studies, SDBs have been found to increase among long tailed macaques (*Macaca fascicularis*) given drugs that have anxiogenic effects in humans, and to decrease when anxiolytic drugs are given (Schino et al., 1996). Behavioural studies lend further support to the idea that SDBs reflect anxiety: expression of SDBs is elevated in situations assumed to be anxiety-inducing, such as after aggression (e.g. domestic goats, *Capra hircus*: Schino, 1998) or when in close proximity to a dominant conspecific (e.g. olive baboons, *Papio hamadryas anubis*: Castles et al., 1999).

In recent years, there has been growing concern about how conservation practice may impact on animals at the emotional, as well as at the physical level (Bekoff, 2007, 2008). To our knowledge, however, there are no published studies investigating wildlife tourism impacts on both anxiety and physiological stress levels of wild animals. We aimed to investigate such impacts among male Barbary macaques (*Macaca sylvanus*) in Ifrane National Park, Middle Atlas Mountains, Morocco. Barbary macaques are the only non-human primate living wild in North Africa, being found in mountainous regions within the cedar and oak forest ecosystem of Morocco and Algeria (Ménard and Vallet, 1997; Mouna and Camperio Ciani, 2006). In 2008, the species was classified for the first time as endangered by IUCN (Butynski et al., 2008). Recent studies show that the wild population of Barbary macaques has dramatically declined since the 1980s, with fewer than 10,000 individuals now thought to remain; the Middle Atlas Mountains are home to the largest remaining populations of this species but even here numbers are in decline (van Lavieren and Wich, 2010; Mouna and Camperio Ciani, 2006). Primate viewing tourism in Morocco is a relatively recent phenomenon, and its impact on the animals involved has not previously been investigated. As interest grows in developing the tourism potential of Barbary macaques as a tool for the conservation of this endangered species (Mouna and Camperio Ciani, 2006), studies investigating such effects are urgently needed.

2. Materials and methods

2.1. Study site and animals

The project was conducted at a site in Ifrane National Park in the Middle Atlas Mountains, Morocco (33°25'N; 005°10'W) where a group of Barbary macaques has been habituated to regular tourist presence for approximately 5 years. At the time of data collection, this group was composed of 51 individuals: 12 adult males, 12

adult females, 1 sub-adult male, 1 sub-adult female, 14 juveniles, 4 one-year-old infants and 7 newborn infants. The study group falls within the normal species range documented by Ménard (2003) for both group size (13–88 individuals) and adult sex ratio (0.6–1.6). Data were collected on 11 adult males and the sub-adult male; one adult male was excluded from data collection because he was observed to be peripheral to the group.

2.2. Tourism at the study site

The study group come everyday to a tourist site located approximately in the centre of their home range. At this site, there is an area of forest of about 150 m² where there are stalls selling fossils of ammonites and trilobites, and also picnic tables and car parking spaces. Tourists at the site are very variable – in both nature and number – between and within days, but can be classified into two main types. The most common tourism in this area is “quick look tourism”, in which Moroccan or foreign tourists, typically on the way to the Sahara desert or to the city of Fez, stop briefly to see, feed or photograph the monkeys. These tourists vary from solitary individuals to coach tour groups of over 100 people. The second type of tourism is linked with the picnic area. Moroccan families spend much of the day enjoying a meal here; generally, these tourists are locals from the surrounding towns (Azrou and Ifrane) and they most commonly come to the site during the weekend.

2.3. Data collection

The study was carried out from 21st February to 11th May 2010 with a total of 47 days of data collection, during which the group was monitored for approximately 9 h per day. Focal behavioural observation and scan sampling techniques were used (Altmann, 1974). Scan and focal samples were alternated throughout each day, with data collection starting at approximately 7:30 am and continuing until approximately 5:30 pm. Focal samples lasting 10 min were used to quantify macaques' rates of self-scratching (the measure of SDB most commonly used by researchers; Aureli, 1997; Carder and Semple, 2008), the rate of occurrence of human-macaque interactions and closest proximity of tourists to the macaques. Scan samples were used to quantify tourist presence, number and proximity; these samples were carried out between successive focal samples. Two focal samples were recorded for each male per day, one in the morning and one in the afternoon. The order of focal samples across males within each time block (morning/afternoon) was randomised.

All focal data were collected using a Psion WorkAbout handheld computer loaded with Observer software (version 5.0). At the beginning, middle and end of the 10 min focal watch, the closest proximity of the nearest tourist to the focal animal was recorded. Self-scratching and human-macaque interactions were recorded as events; two events were distinguished when they were separated by at least 10 s. Human-macaque interactions were separated into three categories: neutral, feeding and aggressive interactions. Neutral interactions were those in which tourists made no attempt to interact directly with the macaques, namely where tourists talked to, waved at or photographed them. Feeding interactions were scored when tourists gave food items by hand or threw such items towards the macaques. Aggressive interactions were those in which tourists pretended to throw – or actually threw – non-food items towards the macaques, or where they physically struck or pushed them. Rates of self-scratching and human-macaque interactions were averaged for each study animal across morning and afternoon focal sessions, to give a mean rate for each male for each day. Closest proximity data (i.e. those recorded at 0, 5 and 10 min) were averaged for each focal watch

Download English Version:

<https://daneshyari.com/en/article/4385539>

Download Persian Version:

<https://daneshyari.com/article/4385539>

[Daneshyari.com](https://daneshyari.com)