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Tourist Behavior and Decibel Levels Correlate with Threat Frequency in Tibetan Macaques (*Macaca thibetana*) at Mt. Huangshan, China

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Abstract: Tourism is a common component of management practices directed toward endangered species and habitats, but few studies have explored the potential stressors that may occur to nonhumans as objects of tourism. We examined the impact that tourists have on provisioned, habituated Tibetan macaques (*Macaca thibetana*). Data were collected during August 2005 at the Valley of the Wild Monkeys (VWM), Mt. Huangshan, China. From a tourist viewing platform, we measured tourist densities, behaviors (for example, foot, hand, and mouth noises; mimicking monkeys; throwing objects or food), and decibel levels. Frequencies of monkey threats in the provisioning area of their range were recorded. The tourists' collective behaviors correlated with monkey threats (Pearson's correlations; $r=0.391$, $p=0.014$), as did decibel levels on the viewing platform ($r=0.334$, $p=0.038$). No relationship between tourist density and monkey threats, or between particular tourist behaviors and monkey threats, was significant. Based on these results, we recommend park staff be trained on how to discourage noise often associated with tourists and regulate prohibited tourist behaviors, such as feeding the monkeys. Enforcement of park rules will decrease chances that tourist-monkey interactions at VWM will escalate into situations where injuries occur, as has happened at some other macaque tourism sites. Finally, we suggest the development of tourist education materials.

Key words: ecotourism, macaques, aggressive behavior, stress

Introduction

During the late 1990s, China's economy was the fastest growing in the world, a trend that has continued into the new millennium (Harkness 1998). Emergence of large numbers of Chinese people in middle and upper economic classes coincides with a rapidly growing domestic tourism industry (Sofield and Li 1998). The rise in tourism has stimulated changes in policies that protect China's wildlife, and nature-based tourism is increasingly popular (Ji and Jiang 2004).

The attraction of tourists to an area demonstrates to local, provincial, and national governments the economic value of the region, but tourism is often accompanied by increased noise and pollution, unchecked development, and the potential for increased human/wildlife contact. This contact can be stressful and detrimental, particularly when there is a potential

for interspecies aggression and disease transmission. Left unmanaged, nature-based tourism can prove harmful to the very area that is being sought out for its natural beauty, unique wildlife, or cultural significance.

Perhaps in part because of their adaptability and inquisitive, bold natures, species in the genus *Macaca* are sometimes the focus of "macaque tourism" (Fuentes *et al.* 2007, p.1144) in Asian countries, within the natural range of the genus. In China, there are two locations where tourists can see Tibetan macaques (*Macaca thibetana*): Mt. Emei in Sichuan Province (Zhao 2005) and the Valley of the Wild Monkeys (VWM), near Mt. Huangshan in Anhui Province (Matheson *et al.* 2006). Both sites are popular destinations for domestic and international tourists.

At Mt. Emei, tourists follow trails from the base of the mountain to its summit. Monkeys approach tourists on trails

and inspect them or their baggage for food (Zhao 1999). Zhao and Deng (1988a) call this behavior “beg-robbing”, which they vividly describe as the monkey “approaching the visitor, often standing bipedally, the animal reached for food in the hand or carrying bag of the visitor, sometimes stealing the bag (Zhao and Deng 1992, p.25).” As a result, trailside tourist-monkey interactions have changed from tourists feeding monkeys as a form of entertainment, to tourists throwing food in self-defense against aggressive monkeys (Zhao 1994).

Mt. Huangshan is located in Anhui Province and is a United Nations World Heritage site (see Figure 1). VWM is south of the main park and receives fewer visitors than does Mt. Huangshan. Visitors to VWM enjoy the beauty of the area, stroll along paved walkways, and climb a series of stairs to viewing platforms from which they can see Tibetan macaques during regularly scheduled feeding sessions by park staff.

We explored the potential impacts of tourism on the behavior of one group of habituated macaques at VWM. We examined whether: 1) the rate of monkey threats (directed toward humans, monkeys, or both) was related to tourist numbers on the viewing platform; 2) the rate of monkey threats was correlated with decibel levels measured on the viewing platform; and 3) specific behaviors engaged in by tourists were associated with increased frequencies of monkey threats. This study has direct implications for management practices at VWM to help reduce negative interactions between humans and Tibetan macaques.

Methods

Data were collected from 11–26 August 2005 at VWM, Mt. Huangshan, China (30°07'09"N, 118°09'41"E; 1,841 m above sea level). Mt. Huangshan is a popular tourist destination famous for an endemic pine species (*Pinus huangshanensis*) found at higher elevations. Lower elevations, where

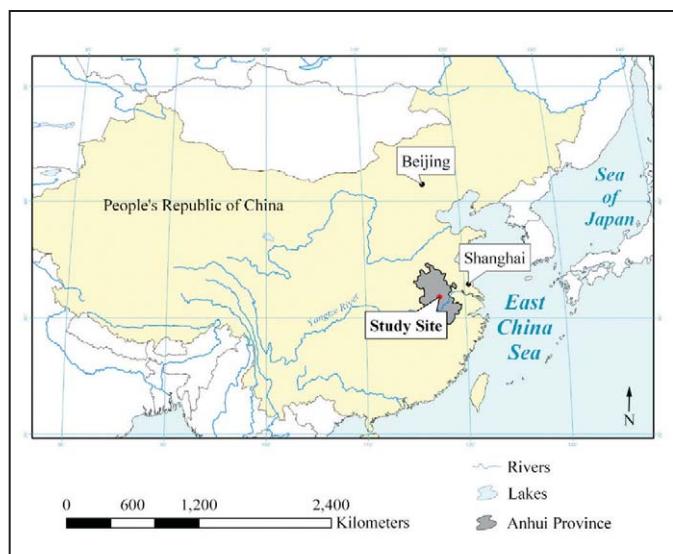


Figure 1. The location of the study site in Anhui Province, China (ESRI 2000, Website: <<http://www.esri.com>>).

Tibetan macaques are found, have mixed evergreen and deciduous forests (McCarthy *et al.* 2009).

The group called Yulingkeng A1 (YA1) was habituated for research in 1986 and for tourism in 1992 (Berman *et al.* 2007). A viewing platform from which tourists could observe the monkeys was constructed in 1994 (Berman *et al.* 2007). Since 1992, park rangers have provisioned monkeys with corn four times each day. This attracts them to areas where they are more easily viewed by tourists and researchers. In 2005, YA1 consisted of 25 individuals: five adult males, five adult females, two subadult males, nine juveniles, and four infants.

In order to record pre- and post-feeding monkey and tourists behaviors, we collected data during intervals corresponding to the four scheduled provisioning times: 09:30–10:30, 13:00–14:00, 15:00–16:00, and 17:00–18:00 h. Each hour constituted a session.

Three researchers collected data during each session. One researcher recorded data on decibel levels and tourist numbers at two-minute instantaneous scans. She continuously recorded tourist behavior between instantaneous records using the tourist ethogram in Table 1. Decibel levels were recorded from the same location on the tourist platform using a Sper Scientific Mini Digital Sound Meter (model number 840014; Sper Scientific Ltd., Scottsdale, AZ). We recorded baseline decibel levels before morning data collection sessions from 2–8 August 2005 ($n=8$ baseline sessions). During these baseline sessions, monkeys, observers, and park staff may have been present, but tourists were not.

During each session, two researchers continuously recorded monkey threat behaviors during two-minute intervals, with each observer focusing on different provisioning areas to rule out overlapping data. They recorded all occurrences of *bite*, *chase*, *lunge*, *slap*, and *threat* (including *ground slap*) using Berman *et al.*'s (2004) behavioral ethogram.

The three data collectors achieved interobserver reliability for monkey identities (for adults) or age/sex class (for immatures) (100%) and monkey threat behaviors (92%) from 3–10 August 2005, prior to formal data collection. The first author (LAR) collected all tourist behavioral data and made *ad libitum* notes on tourist, monkey, and park staff behaviors during each session. Our research methods were approved by the Human Subjects Research and Institutional Animal Care and Use Committees of Central Washington University before the study began.

Results and Discussion

Results yielded a total of 1,046 scans (used for tourist counts and decibel levels) and 1,046 intervals (used for monkey and tourist behaviors). We recorded an average of 1.72 threats per monkey per interval (S.D.=0.96 threats), and an average of 22 tourists on the platform per scan (S.D.=17.12 tourists).

There was no correlation between tourist density and the occurrence of monkey threats ($r=0.153$, $p=0.351$). Average decibel levels were significantly higher on the tourist platform when tourists were present (Student's *t* test, $M_1=58.09$ dB,

$n_1=88$, $M_2=60.13$ dB, $n_2=1,040$, $df=1$, $t=-2.96$, $p=0.003$). Positive correlations occurred between decibel level and the occurrence of monkey threats ($r=0.334$, $p=0.038$; see Figure 2), and the total frequency of tourist behaviors and the occurrence of monkey threats ($r=0.391$, $p=0.014$; see Figure 3). However, correlations between the frequency of particular tourist behaviors (Table 2) and monkey threats were not significant.

Four situations occurred regularly in *ad libitum* notes taken during each session: 1) monkeys on the tourist platform with tourists and park staff ($n=108$ times); 2) tourists feed monkeys with corn provided by park staff ($n=102$ times); 3) tourists feed monkeys with food brought to the viewing platform ($n=39$ times); and 4) park staff reprimand tourists for feeding monkeys ($n=9$ times).

We found no correlation between tourist density and the occurrence of monkey threats. Perhaps the freedom to forage and the routine of scheduled feeding times mitigates negative aspects of large tourist groups on the platforms. Also, park staff spread corn widely around the provisioning area, so monkeys could forage some distance from tourists. Park

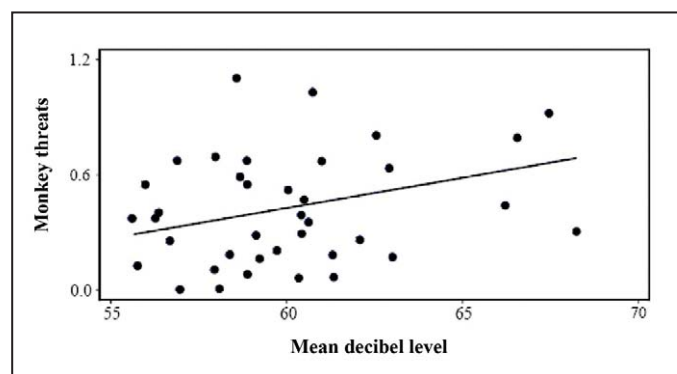


Figure 2. Decibel level on tourist platform and frequency of monkey threats ($r=0.334$, $p=0.038$).

Table 1. Tourist behavioral ethogram.

Behavior	Description
Foot noise	Tourist stamps feet or kicks wall in tourist platform.
Hand noise	Tourist makes noises with one or both hands (clap, snap, smack own body, smack a book).
Mimic ^a	Tourist mimics facial expressions and/or body movements of a monkey threat (eyebrow raise, stare).
Mouth noise	Tourist makes noise (whistle, kissing noises, shouts) with mouth directed toward monkey.
Point	Tourist points at monkeys; arm extends out of tourist platform.
Rock ^b	Tourist pretends to throw rock at monkeys.
Slap rail	Tourist slaps rail or post on tourist platform using hands and/or objects.
Throw food	Tourist drops or throws food item into the monkey area, or directly to a monkey.
Throw object	Tourist drops or throws nonfood item (tissue, wrapper, rock) into monkey area.
Wave	Using hands or objects, tourist waves at monkey

^a If mimicry included slap, it was coded as *Mimic*, not *Slap rail*.

^b If rock was thrown, it was coded as *Throw object* not *Rock*.

staff monitored where monkeys were and used their voices to encourage monkeys to come closer to the tourist platform to eat corn. However, monkeys could and did avoid the tourist platform altogether. In the past, park staff used more restrictive “herding” methods (Berman *et al.* 2007), essentially forcing monkeys into the provisioning area, but from 2005 through 2009 (our most recent research at the site), staff primarily monitored the monkeys’ locations and allowed them to approach the platform at will. This management technique may help to reduce the potential stress posed by large numbers of people.

Overall, behaviors exhibited by tourists were positively correlated with the occurrence of monkey threats (Figure 3). Tourist behaviors were often of an attention-seeking nature, such as waving, throwing food, making noises, or mimicking the monkeys’ behaviors, and tourists seemed to continue any behavior that elicited a response from the monkeys. Indeed, in another study conducted at VWM, McCarthy *et al.* (2009) found that tourists tended to initiate interactions with monkeys and repeated a behavior until a monkey responded; the monkey’s most common response was to threaten the tourist.

Although all tourist behaviors taken together had a significant impact on the occurrence of monkey threats, individual tourist behaviors did not (Table 2). This may be due to the varied types of behavior tourists engaged in and the resulting small sample size for each behavior. *Throw object* appears to be a candidate for additional research ($r=0.927$, $p=0.073$,

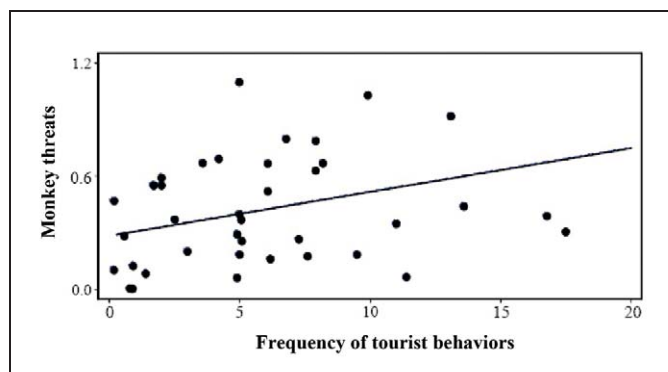


Figure 3. Frequency of all tourist behaviors and frequency of monkey threats ($r=0.391$, $p=0.014$).

Table 2. Occurrence of tourist behaviors.

Behavior	N	Percent	r	p (n. s.)
Point	676	45	-0.0362	0.5981
Mouth noise	252	17	-0.0858	0.4352
Wave	241	16	0.0628	0.5874
Throw food	153	10	-0.1417	0.2565
Hand noise	57	4	-0.1669	0.5521
Mimic	40	3	-0.0110	0.9634
Throw object	17	1	0.9272	0.0728
Rock	9	<1	0.5452	0.2632
Slap Rail	2	<1	0.0215	0.9349

Note. Percentage of individual behaviors derived from total of all behaviors ($N=1,503$); some behaviors occurred that were not on the tourist ethogram.

which is suggestive considering its small representation in the data set: $n=17$, or 1.13% of all intervals). Of note, rock throwing is the primary means used by park staff to discourage monkeys from climbing on the platform and being aggressive toward tourists; in the recent past but to a lesser extent now, it was used to herd monkeys when they strayed too far from the provisioning area (Berman *et al.* 2007). The monkeys showed a pattern of fleeing from, but directing threats towards, park staff (Jones *et al.* 2008), so it is not surprising that having tourists show or throw rocks would be perceived as particularly alarming to them. Similarly, McCarthy *et al.* (2009) found that monkeys responded with threats to the tourist behaviors *point* and *slap rail*. The latter mimics a macaque threat behavior, *ground slap* (Berman *et al.* 2004), and thus may be perceived by the monkeys as a threat towards them.

Average decibel levels on the tourist platform were correlated with the occurrence of monkey threats (Fig. 2). Noise emitted by tourists is unpredictable and uncontrollable, and thus meets two criteria for what constitutes a stressor to animals (Wingfield and Kitaysky 2002). Noise is a component of many of the tourist behaviors described in this study: *mouth*, *foot*, and *hand noise* and *slap rail*. These tourist behaviors were directed towards monkeys as they approached the platform and tourists attempted to engage the monkeys or instigate a reaction from them.

VWM park staff instituted provisioning in 1992 to facilitate tourism and research (Berman and Li 2002). During this study through 2009, VWM monkeys were fed dried corn four times each day. The corn was scattered widely throughout the area of the monkeys' home range that is adjacent to the viewing platforms. Boccia *et al.* (1988) found that use of low-quality, widely distributed foods for provisioning reduced feeding competition among nonhuman primates, and that appeared to be the case at VWM: although monkeys did threaten one another over corn, it was too widely dispersed, and perhaps of too low a nutritional value, for one or a few animals to dominate access to it. Foods provided by tourists, by contrast, tended to be high quality (calorie- and fat-dense) and clumped in distribution and included energy drinks, soda, sugary rolls, fruit, and nuts tossed whole into the provisioning area. Such foods created quite a stir among the monkeys, and high ranking animals dominated access to them. Hapless tourists often attempted to toss food to juveniles and infants, unaware that this made the young monkeys the target of aggression from more dominant adult animals.

While not explicitly examined in our formal data collection, it seemed likely that some of the monkey threats we observed were related to the tourists bringing these highly prized foods onto the tourist platform, apparently intending to feed the monkeys. Our *ad libitum* notes indicated that monkeys received food in addition to provisioned corn from park staff or from tourists during approximately 15% of data collection time. Sometimes park staff let tourists feed corn to the monkeys from a small can (for free or in exchange for a small fee) as a photo opportunity. Monkeys, usually one or two particular adult males well-known to park staff, were sometimes

urged by staff to sit on the platform rail next to tourists, again as a photo opportunity. Both practices, however, have apparently stopped, and since 2005, we have not observed staff-encouraged feeding by tourists. Indeed, our *ad libitum* data showed that park staff reprimanded tourists for offering treats 23% of the times they occurred, but tourists often resumed when staff were not looking. Through 2009, we have seen local villagers within the park selling foods to tourists to give to the monkeys, so a mixed message is sent to tourists about whether or not feeding is allowed.

At VWM, the combination of tourists, food, and monkeys on the platform typically ended in threats from the monkeys and their eventual retreat when park staff approached, but occasionally escalated into more serious problems. In 2005, an adult male macaque sat on the railing of the tourist platform and was hand fed by tourists while they posed for photographs with him. Suddenly, the monkey hit a male tourist on the side of his head, knocking off his glasses. In 2008, an adult male monkey was aggressively approaching a little girl with a pear in her hand; the ranger moved between the two and received deep puncture wounds on his back from the monkey's canine teeth.

Tourist-provided food is associated with negative monkey-human interactions at other sites too. Zhao and Deng (1988b) characterized several behaviors that tourists were engaged in that preceded aggressive encounters with one or more Tibetan macaques, including enticing monkeys with food, posing for pictures with monkeys, and trying to touch monkeys. Fuentes (2006) found that when tourists fed long-tailed macaques (*M. fascicularis*) at Sangeh Monkey Forest in Bali, it increased the occurrence of their aggressive behaviors. Tourists at Sangeh often received bites or scratches when holding food, and of those injured by monkeys almost 95% of them were holding food (Engel *et al.* 2002). Hsu *et al.* (2009) found that illegally provided food increased the frequency and duration of aggressive interactions between humans and Formosan macaques (*M. cyclopis*) at Shou Shan Nature Park in Taiwan. Fuentes and colleagues (2007, p.1155) noted: "... the food tourists bring appears to be the primary stimulus for macaque-human interactions." Limiting monkeys' access to food will likely reduce opportunities for tourists to be bitten, scratched, or threatened.

Fuentes and Gamerl (2005) noted that because tourists stay only a short time at sites such as VWM, they do not learn how to safely interact with monkeys, but the monkeys have repeated opportunities to learn how to manipulate human behavior to obtain food. An effective form of manipulation is to threaten or be aggressive towards the tourists. Close contact and injury associated with tourist food handouts to monkeys are related to the possibility for bidirectional disease transmission (Jones-Engel *et al.* 2006). Tourists should be warned of the risks of feeding monkeys and should be dissuaded from doing so. At VWM, park staff practices of encouraging tourists to hand-feed monkeys and allowing tourists to pose for pictures with monkeys on the platform have not been seen since 2005, but it is still the case that tourists often arrive with

food and the apparent intent of feeding monkeys, and tourists disregard the staff's admonitions against doing so. Signs were posted throughout VWM stating that monkeys should not be fed, but as was true at the sites studied by Fuentes *et al.* (2007), we found that tourists ignored signage.

Throughout its time as a macaque tourism site, VWM has been characterized by relatively low levels of negative monkey-human interactions. Tourists stayed on the viewing platform, and monkeys infrequently approached them on cement pathways leading to the viewing area. However, without continued careful management of tourist-monkey interactions, VWM could become more similar to Mt. Emei or other sites where higher rates of monkey-human aggression have been reported (Zhao and Deng 1992; Fuentes and Gamerl, 2005; Zhao 2005; Sabbatini *et al.* 2006; Fuentes *et al.* 2007). It is also possible that tourism poses a stressor to VWM monkeys, thereby undermining the conservation and research goals established for the site (Berman and Li 2002).

Recommendations

Our data show that it is not merely the presence or total number of tourists on the platform that precipitates macaque threats, but rather what the tourists are doing and the amount of noise they make. To reduce the stress of tourism on the VWM monkeys and to ensure a more pleasurable visit for tourists, we recommend that:

1. Staff continue with the less restrictive "herding" methods that have been in place at this site since 2002. These allow monkeys more control over whether they will come near the viewing platform and may reduce the potential stress of forced interactions with humans;
2. tourists continue to be confined to the platform when viewing monkeys to reduce the chance of negative encounters with monkeys on pathways (as occurs at Mt. Emei, for example);
3. staff continue provisioning only with corn rather than more highly desired and easily monopolized foods, and staff enforce rules against the general public feeding monkeys;
4. only staff provide foods, so that monkeys do not associate food with tourists;
5. there be a higher ratio of staff to tourists, which would make it possible for staff to keep better watch over tourists and reduce opportunities for surreptitious feeding; and
6. tourists be better informed and educated about monkey behavior. Tourists may not realize that their behavior mimics macaque threats, or that the behaviors shown by the monkeys are indicative of fear, stress, or annoyance. Tibetan macaques appear to find the noise associated with tourists stressful. Tourists should be educated on the need to speak softly when on the viewing platform. Quiet tourists would reduce the need for park staff's use of a microphone. Abrupt human vocalizations such as shouting seem to startle the monkeys, and tourists should be

told to avoid making such noises when near the monkeys. Tourists should also be encouraged or required to wear disposable face masks while on the viewing platform. This would greatly reduce the risk of disease transmission and would provide opportunities to educate the public about the close biological and evolutionary relationship among primates. A better understanding of the monkeys, and of the effects of the tourists' own actions, may lead to a more positive tourism experience.

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