



Qualitative Assessment of Macaque Tourist Sites in Padangtegal, Bali, Indonesia, and the Upper Rock Nature Reserve, Gibraltar

Agustín Fuentes · Eric Shaw · John Cortes

Received: 5 January 2006 / Revised: 29 August 2006 / Accepted: 13 September 2006
© Springer Science + Business Media, LLC 2007

Abstract Human tourists share space with, touch, feed, and otherwise interact with *Macaca* at multiple locations. Across Asia and stretching to Gibraltar and Northern Africa, macaques form a substantial tourist attraction as their ranges become increasingly coincident with human use zones. Residing in or as tourist attractions, macaques frequently generate economic benefits to local humans and compete with them for habitat and specific resources. In addition, health conflicts may emerge from increased overlap and interactions between humans and macaques. There is only a handful of studies on the impact, structure, context, and cultural ecology of macaque tourist sites. We provide a general overview of 2 macaque tourist sites, one in Padangtegal, Bali, Indonesia and one in Gibraltar. Qualitative assessment reveals variability in behavioral, ecological, economic, and politically relevant facets of macaque tourism. Specifically, differences in aggression during interactions, potential health dangers, economic factors, and local human perceptions between Padangtegal and Gibraltar suggest that qualitative assessments can assist in our construction of broader models and conceptualizations of the interaction context.

Keywords Bali · commensalism · conflict · Gibraltar · macaque tourism · qualitative assessment

Introduction

Primates are a substantial presence in the realm of tourist interest. For many primatologists, and much of the public, discourse on primate tourism focuses

A. Fuentes (✉)

Department of Anthropology, University of Notre Dame, Notre Dame, IN 46556-5611, USA
e-mail: afuentes@nd.edu

E. Shaw · J. Cortes

Gibraltar Ornithological and Natural History Society (GONHS), PO Box 843, Gibraltar, Gibraltar

primarily on ape tourism, via mountain gorillas, *Gorilla gorilla berengei*, and orangutans, *Pongo pygmaeus* and *Pongo abelii*, and aspects of ecotourism impacting endangered primate species. However, in areas ranging from Asia to North Africa to Europe, tourism with a focus on viewing and interacting with macaques is becoming a significant feature of the human-nonhuman primate interface (Fuentes *et al.* 2005; Zhao 2005). This human-nonhuman primate interface is one of the most important foci for primatological study in the new century (Fuentes and Wolfe 2002; Jones-Engel *et al.* 2005; Patterson and Wallis 2005). Our aim is to illustrate qualitatively the importance of site differences in assessing one aspect of the human-nonhuman primate interface: macaque-focused tourism.

Macaque tourism is directed at viewing and interacting with macaques in a variety of free-ranging or semifree-ranging habitats. This is different from most definitions of ecotourism, which emphasize responsible travel to natural areas that conserves the environment and improves the welfare of local people (Honey 1999). Honey (1999) described true ecotourism as containing the following components: it involves travel to natural destinations, minimizes impact, builds on environmental awareness, provides direct financial benefits for conservation, provides financial benefits and empowerment for local people, respects local culture, and supports human rights and democratic movements. Though macaque tourism does not fit into all of the contexts, it resides in the continuum of ecotouristic endeavors. Tourists visit macaques at a multitude of locations in habitat countries; many local peoples are economically involved in the process; and in many cases there are educational or conservation outcomes. However, in the areas of overlap between humans and macaques there is also the potential for conflict. One can view macaque tourism as an important locale to examine interactions between humans and macaques (Zhao 2005).

When asked about their reasons for visiting macaques, >50% (275/500) of tourists surveyed at the macaque tourism sites of Padangtegal, Sangeh, Alas Kedaton (Bali, Indonesia), and Gibraltar (Europe) responded with answers such as “interest in wildlife,” “natural,” “nature education,” and “seeing the monkeys.” Thus for tourists, a visit to the macaque location and viewing or interacting with the macaques constitutes a nature experience. In addition to visitors deriving pleasure from interacting with or feeding macaques, Zhao (2005) noted that at sites associated with Buddhist (or Hindu, Fuentes *et al.* 2005) temples practitioners and pilgrims see interacting, and feeding, the macaques as a way to acquire spiritual merit.

Macaque tourist sites are present throughout Asia frequently in or around Hindu and Buddhist temples. The species most typically at the Asian interaction sites are *Macaca fascicularis* (Southeast Asia [SEA]), *M. mulatta* (South Asia and Northern SEA), *M. fuscata* (Japan), *M. sinica* (Sri Lanka), and *M. thibetana* (China). Other species such as *Macaca assamensis* (Northern SEA), *M. nemestrina* (SEA), and the Sulawesi macaques (*Macaca* spp.) also live at such sites, but less frequently (Agiramarangsee 1992; Berman *et al.* in press).

In North Africa (Morocco and Algeria) interaction sites are present primarily in montane and rural areas largely at human recreation locations, which may or may not have governmental designations as parks and where tourist experiences are for the most part uncontrolled. The interactions are exclusively with *Macaca sylvanus*. In Gibraltar on the Iberian Peninsula, interactions with a population of *Macaca sylvanus* occur in the Upper Rock Nature Reserve. In Europe, Japan, and the United

States tourists also view and interact with macaques in monkey parks such as Alpenhuel, Japan Monkey Park, and Monkey Jungle. In the majority of the locations from Asia to Europe, the macaques are at least partially provisioned by a segment of the local human population and by the tourists who come to visit them. In all of the sites humans can interact to some degree with the macaques and thus the problems of conflict, aggression, feeding, and management may be similar.

Assessing Tourism and Macaques

There is a small, but growing, literature related to macaque tourism (Agimarangsee, 1992; Fa 1984, 1992; Berman *et al.* *in press*; Fuentes 2006a, b; Fuentes and Gamerl 2005; Matheson *et al.* 2006; O'Leary and Fa 1993; Wheatley 1999; Wheatley and Harya Putra 1994; Wolfe 1991, 2002; Zhao 1991, 2005). Only 4 locations (Padangtegal, Bali, Indonesia; Gibraltar; and Mt. Hungshen and Mt. Emei, China) are the focus of specific research into macaque tourism/the macaque-human interface (Berman *et al.* *in press*; Fuentes 2006a; Wheatley and Harya Putra 1994; Zhao 2005).

For fairly obvious reasons, macaque tourist sites require management (Fa and Lind 1996; Fuentes and Gamerl 2005; Fuentes 2006a, b; Zhao 2005). To develop appropriate and effective management practices, studies of macaque tourism should involve elements that impact stakeholders, both human and nonhuman. As such one can lay out a set of potential benefits and detriments involved in situations of macaque tourism (Table I). In describing the benefit/detriment relationship between humans

Table I Potential impacts of macaque tourism based on commensalism-conflict definitions of Zhao 2005

Commensalisms resulting from macaque tourism	<p>Economic, local income: If activity/sites are primarily under the control of the local human population, income generation can potentially benefit the local community.</p> <p>Economic, management income: Tourists' fees for viewing/entering the site result in income generation, some of which may be used toward macaque provisioning and other site management practices.</p> <p>Education: Interest in the macaques and locations provides a potential for education/awareness of tourists.</p> <p>Macaque protection: Macaques themselves may benefit from tourist interest, e.g., receive additional food provisions, protection from predators, and possibly veterinary assistance from local human populations.</p>
Conflicts resulting from macaque tourism	<p>Disease transmission: High rates of interaction and physical contact can result in increased risk of bidirectional pathogen transmission.</p> <p>Distorting macaque physiology: High rates of provisioned foods may include high-carbohydrate and other anthropogenic foods that may result in reduced activity rates and increased adipose deposition in the macaques. Birth rates may increase or decrease relative to normative patterns, life span may be altered, growth rate/body size may change.</p> <p>Behavioral conflict: High overlap with human populations can lead to increased conflict and competition, especially in macaque populations. Size increases as a result of tourism and/or management practices.</p> <p>Economic, conflict: The potentially large economic impact of a macaque touristic site can result in local conflict between human stakeholders, especially as the majority of the locations are in relatively economically impoverished places.</p>

and macaques at interaction sites Zhao (2005) defined commensalism as a positive interaction between humans and macaques, with mutual benefits. The use of commensalism is similar to Wilson's (1975) social mutualism in which both species benefit rather than his social commensalism in which one species benefits and the other is unaffected. We follow Zhao's (2005) use of the term because it is established in the literature on macaque-human interactions (Patterson and Wallis 2005). However, we recognize its more common ecological use per Wilson (1975). Zhao (2005) also described conflict as a relationship that can be physically injurious to both humans and the macaques. Attempts to understand macaque tourism require both assessment of quantitative interindividual interaction data (Fuentes 2006a; Fuentes and Gamelr 2005; Zhao 2005) and qualitative assessment of potential commensalisms and conflicts (as per Zhao).

We review 2 examples of macaque tourist sites, with a focus on the qualitative cultural and management contexts and the potential positive and negative impacts of the commensalism and conflict (Zhao 2005) between macaques and humans.

Two Examples of Macaque Tourism

We report data from studies at Padangtegal, Bali, Indonesia, and Gibraltar, where we collected data at different times and collected data under slightly different protocols. The international multiuniversity research teams of the Balinese Macaque Project collected data between 1998 and 2003 (Fuentes 2006a; Fuentes *et al.* 2000, 2005). We used some information for the Bali site from the late 1980s and early 1990s gathered by Wheatley (1999). Data for the Gibraltar site are from ongoing work by the Gibraltar Ornithological and Natural History Society (GONHS), previous research at Gibraltar (Burton and Sawchuk 1984; Fa 1984), and the recent (2004–present) research collaboration between GONHS and the University of Notre Dame (Fuentes 2006b). The basic demographic and structural information for the 2 sites are in Table II.

Table II Basic demographics and structure at both sites

Site	Area	Macaque population size ^a	Groups	Human density	Macaque population use range	Diet
Padangtegal	Temple complex , Forest, villages	220	3 groups, all multimale/female	456 per km ²	28 hectares	70% provisioned 30% nonprovisioned
Gibraltar	Nature Reserve, Gibraltar City	235	6 groups, all multimale/female	2800 per km ²	900 hectares	76% provisioned 24% nonprovisioned

^a As of 2003 for Padangtegal and 2006 for Gibraltar.

Management at Padangtegal

Since 2000, a committee assembled by the village of Padangtegal and headed by an appointed director has actively managed the site. Though some management was in place since the 1980s (Wheatley 1999), it did not involve systematic provisioning, forest conservation/reclamation, and behavior management of the macaques until 1999 (Table III), which corresponds with the dramatic increase in tourists from the mid-1990s. Much of the change in management is attributable to the more active involvement of the newly appointed full-time manager in 1999–2000 and a standardization of management practice and priorities between 1999 and 2003. Local temple staff provision the macaques (since the late 1980s), and in 1999 systematic provisioning of multiple species of food items began. The current management committee places provisioned foodstuffs—primarily sweet potatoes, papaya leaves, and 3 species of local foliage—in ≥ 5 areas throughout the site twice daily. Staff members also spot-feed 6–9 additional plant and fruit species by occasionally spreading food at different locations throughout the site during the day.

Between 1998 and 2003 researchers provided data-based assessments of macaque behavior (based on >600 h of observations), human-macaque interactions (>500 interactions 2000–2002), and visitor feedback (>300 tourist interviews 2000–2002)

Table III Management history of Padangtegal Wenara Wana

1980s–1990	<p>Local temple staff responsible for provisioning of macaques and maintenance of temple forest and grounds</p> <p>Macaque population <100 individuals</p> <p>Macaques provisioned with sweet potatoes</p> <p>Some tourism, minimal or no entrance fees, no specific management team or director</p>
1990–1998	<p>Macaque population <i>ca.</i> 100 individuals</p> <p>Village appointed manager and few staff</p> <p>Some behavior and ecological assessment carried out by Dr. Bruce Wheatley (University of Alabama) (1989–1994) with recommendations made to Village committees</p> <p>Increase in amount of provisioned foodstuffs</p> <p>Initiation of informational signs and ticket booths at site</p> <p>Some collaboration with veterinary doctors for issues of macaque health</p>
1999–present	<p>Macaque population >200 individuals</p> <p>Formalized management system with a full-time manager and dedicated staff on site during daylight hours</p> <p>Increase in diversity, location and style of provisioning</p> <p>Collaboration with Universitas Udayana (Denpasar, Bali) on research and veterinary issues.</p> <p>Recommendations about macaques and site management made annually and largely implemented by management staff</p> <p>Reclamation of some surrounding land and planting of >300 trees to expand the forest area for macaque use</p> <p>Irrigation system improvements facilitate distribution of water to various locations in the forested areas.</p> <p>Close forest area to vehicle traffic and enhancement of all paths in the forest</p> <p>Active engagement with owners of surrounding rice fields in effort to reduce crop raiding</p> <p>Behavior modification of highly aggressive male macaques</p>

to the management staff annually. Changes in management practice initiated during the period (2000–present) included behavior management, i.e., reducing aggression of certain macaques via staff shadowing them and constantly interfering when they were aggressive toward tourists; increasing the diversity of food types and feeding locations/times; waste removal and control, including removal of >1000 kg of plastic and refuse from the soils; and habitat restructuring. Collaboration with Universitas Udayana, Bali, Indonesia, facilitated the creation of onsite education programs — increased signage and brochures- and medical intervention for the macaques.

Tourists, local people, and human impact Balinese, other Indonesian, and foreign tourist companies advertise Padangtegal and the surrounding town of Ubud as a major tourist destination; thus tourists from around the world visit the site on a regular basis. Entrance into the forest site cost *ca.* 10,000 rupiah (*ca.* 1 USD) per adult. Balinese, and in practice most Indonesian nationals, are allowed entrance into the temple grounds free. Tour guides are expected to pay for their tour groups; however, larger groups and the ones Balinese operate receive substantially reduced entrance fees. The 100,000–200,000 tourists who visited the site annually came from >23 countries, with the majority of non-Asian visitors from North America, New Zealand, Australia, and Europe, making up >50% of the tourists (as of 2003). Asian tourists are primarily Japanese and Taiwanese, but Indonesian tourists from Java (especially Jakarta) and school children from Bali and Java also visit during holidays (Stephenson *et al.* 2002). A majority of Indonesian tourists who come to Bali usually visit the other monkey forest sites of Alas Kedaton and Sangeh *ca.* 20 km from Padangtegal (Fuentes *et al.* 2005). Stephenson *et al.* (2002) demonstrated that 75% of tourists visiting Padangtegal were first-time visitors to Bali, whereas 18.5% had visited Bali 2–5 times, and a small percentage had visited >5 times. The majority of non-Indonesian tourists arrive in Bali via airplane from their country of origin and arrive in coach/motor car from other areas on Bali to Padangtegal. There are also tourists who arrive via ferry in coaches and motor cars from Java as part of package tours. All of them have a substantial impact on the local community's economy. In addition to paying entrance fees, they shop in local markets adjoining the site and eat in local restaurants.

Since 2000, tourists have received information regarding macaque behavior and ecology from a Wenara Wana management committee brochure assembled in collaboration with researchers. It contains information on the macaques and a history of the Padangtegal temple complex. Some of the management staff are multilingual and act as informants for tourists. There is no official guide for the site; however, coach drivers and tour leaders frequently provide information, which may or may not be accurate.

All 3 of the macaque groups interact with tourists daily. Tourists have equal access to all areas of the site on foot, and interactions are initiated by tourists and macaques (Fuentes and Gamerl 2005). The strongest enticement for contact appears to be the presence of food or the suggestion of it: plastic bags, items wrapped in banana leaves, etc. Clear and consistent warning signs are posted at all main areas within the temple forest stating that feeding the macaques is dangerous and requesting that visitors not do so. The signs carry explicit warnings of the potential dangers of interacting with the macaques and offer instructions for tourists intent on feeding them. The management staff tentatively attempt to dissuade contact

interactions between humans and macaques by monitoring interactions and issuing vocal warnings to tourists who feed them in potentially dangerous manners, i.e., teasing or luring them onto their bodies. However, despite the posted no-feeding guidelines, management staff rarely intercedes in tourist feeding macaques unless aggression occurs. Rates of aggressive interactions and bites are high, with 11.4% of aggressive interactions between humans and macaques resulting in bites (48 of 420 interactions, Fuentes and Gamerl 2005). Given the prevalence of a wide array of simian enzootic infectious agents in the macaques on Bali (Engel *et al.* 2002; Jones–Engel *et al.* 2005) and limited control over feeding, there may be risk of pathogen transmission between humans and macaques at the site.

Macaque groups vie for access to the central area with the largest of the 3 groups dominating access during the peak of tourist visit times (Fuentes, *unpublished data*). Because tourists provide food, primarily sliced cucumbers, coconut, and peanuts purchased outside the entrance of the forest, for the macaques, their visits may impact macaque health. Before 1999 the macaques of Padangtegal regularly raided neighboring rice fields and gardens. Over the last 6 yr, as the provisioning strategy changed, the frequency of raiding the fields decreased, as measured by reduced complaints by farmers and observations by the Padangtegal staff (Manager Padangtegal Wenara Wana, *pers. comm.*).

Management at Gibraltar

Fa (1984), O’Leary and Fa (1993), Perez and Bensusan (2005), and Shaw and Cortes (2006) reviewed the history of the Barbary macaques on Gibraltar. From before the turn of the 20th century until the mid-1990s there were 2 main groups of macaques in the population at Gibraltar, one at Ape’s Den (formerly Queen’s Gate) and another at Princess Caroline’s Battery. By 1946 both groups were provisioned separately by the British military garrisoned in Gibraltar, and by 1970 provisioning for the Princess Caroline’s Battery group was moved to Middle Hill (previously a military area, now an area with human access restricted by the Gibraltar government) to reduce macaque incursions into Gibraltar city (Fa 1984). From 1972 onward, the Middle Hill group had minimal interactions with nonmilitary humans whereas tourists and locals have regularly visited the Ape’s Den group at least since 1936 (Fa 1984). Increased human interactions began in 1960 with the promotion of Gibraltar macaques at Ape’s Den as a tourist attraction. When tourism increased during the 1980s–1990s, economic pressures came to bear on the taxi drivers and tour guides ferrying tourists to visit the macaques, which resulted in illegal provisioning by some Gibraltarians at new areas on the Rock of Gibraltar (Perez and Bensusan 2005). By the late 1990s, provisioning contributed to fission of extant groups that by 2004 resulted in 6 groups in the Upper Rock Nature Reserve (Shaw and Cortes 2006). Today the main interaction sites are Apes’ Den, Anglian Way/St. Michael’s Cave, Prince Phillips Arch, and the Cable Car station at the top of the Rock. Since 1999, the Gibraltar Ornithological and Natural History Society (GONHS) has fed, managed, and cared for the macaques under an agreement with the Government of Gibraltar. GONHS provision the macaques at 5 locations in the reserve (Table IV), providing a selection from 15–16 kinds of fruits and vegetables plus grains every day of the year (Perez and Bensusan 2005).

Table IV Management history of Gibraltar

1940s–1980s: military management	Two macaque groups provisioned by military population numbers controlled by selective culling by military (population size 20–60 individuals) Macaques introduced into population from North Africa Minimal tourism
1980–1990s: sites management	Population size >100 individuals Transition from military to private management corporation (Sites Management) Research on basic behavior and human-macaque interactions at Ape's den Dramatic increase in tourism Beginning of fissioning of existing 2 groups into multiple groups Gibraltar veterinarian charged with health assessment and population control Population control via exporting and culling
1998–present: GONHS management team	Population size >200 individuals Final split into 6 groups related to spot feeding by tour operators Shift from 1 to 3+ interaction sites Daily provisioning by GONHS staff at 5 locations Population control via exporting and culling Increased research activities across multiple groups/sites Collaboration on health assessment between GONHS and Gibraltar Veterinarian resulting in medical intervention and treatment in cases of serious wounding/illness Increased warning signage Collaboration with cable car tour operators on management of local group of macaques

Interactions with humans are a substantial aspect in the daily lives of the Gibraltar macaques (Fa 1984; Fa and Lind 1996; O'Leary and Fa 1993; Perez and Bensusan 2005; Shaw and Cortes 2006). Long-term exposure and subsequent habituation to human presence suggests that they are fully acclimated to being around humans (Fuentes 2006b; Shaw and Cortes 2006). Based on a series of observations at the Ape's Den site, Fa (1984) suggested that human presence and tourist provisioning have a negative impact on macaque reproduction, leading to physiologically stressful outcomes. However, we propose that the current strategy of feeding groups a total of >43,000 kg of food annually (Perez and Bensusan 2005) lessens the impact of humans and that the multigenerational exposure to high numbers of humans in the current macaque population has altered their perceptions and physiological responses relative to earlier times (Fa 1984).

Though many residents of Gibraltar complain that the macaques are pests, observations from 2002–present suggest that while there is some damage—trash bin and occasional kitchen raiding in Gibraltar city and Catalan Bay—it remains minimal overall and is confined to only 2 macaque groups (GONHS, *unpublished data*).

Tourists, locals, and human impact Approximately 800,000 tourists from >19 countries visit the Upper Rock reserve annually, including >72,000/mo during peak season (June–September, Perez and Bensusan 2005). Visitors to the Upper Rock Nature Reserve pay a £7 entrance fee (*ca.* 12.67 USD or 10.57 euro). The majority

of tourists entering Gibraltar are from the European Union and on day visits from neighboring Spain, which borders Gibraltar. Tourists crossing the border are ferried up to the Upper Rock Nature Reserve either by Gibraltar taxis/coaches, via a cable car to the top of the Nature Reserve, or by automobile. Approximately 2% of people visiting Gibraltar arrive on cruise ships and yachts, and *ca.* 1.3% by air (Perez and Bensusan 2005). In 2002, 1,758,460 motor vehicles, including 12,407 coaches, crossed into Gibraltar from Spain and an estimated 60,000 vehicles, including taxis, coaches, and private vehicles, passed through the macaque sites in the Upper Rock Nature Reserve (Perez and Bensusan 2005). Gibraltar-based companies own all coaches and taxis transporting visitors up to the Nature Reserve.

All interaction sites in the reserve have clear and consistent warning signs stating that feeding the macaques is illegal, listing a £500 fine, and warning humans of the potential dangers of interacting with them. However, many taxi and coach drivers encourage interactions, luring the macaques onto the shoulders or head of the tourists for a photograph. Lack of enforcement of the no-feeding regulations perpetuates the problem and the government currently has no plan to fund management staff on site at tourist interaction locations.

The macaque groups do not interact with tourists on an equal basis (Fuentes 2006b), resulting in daily contact between them only at 3: Ape's Den, Prince Phillip's Arch, and St. Michael's cave. There is significant skewing of participation in aggressive interactions between macaques and humans, with adult male macaques (227/808 interactions) and adult male humans (481/808 interactions) engaging in the most frequent interactions relative to their representation in the population (Fuentes 2006b; O'Leary and Fa 1993). Relative to Bali there are few serious aggressive interactions, with the overall bite rate being substantially lower in Gibraltar than on Bali (1.2% of aggressive interactions, 10 bites in 808 interactions, Fuentes 2006a).

In Gibraltar, the potential for macaque to human pathogen transmission is slight given the low presence of simian enzootic infectious agents in the macaques (GONHS, *unpublished data*) and relatively low rate of biting during aggressive interactions. However, the potential for human to macaque pathogen transmission remains high given the frequent contact between humans and macaques and the fact that when interactions occur they are significantly more likely to include physical contact (70% of all interactions involve some physical contact; Fuentes 2006b). The contacts range from hand-to-hand contact to macaques climbing on humans and sitting on their shoulders or heads. During the interactions, human and macaque faces can be in very close proximity; thus the potential for airborne transmission of respiratory pathogens is high (Woodford *et al.* 2002). O'Leary and Fa (1993) reported a viral pneumonia outbreak at Ape's Den in 1987 that killed all infants born that year.

Tourists visiting the macaques on the Rock impact the local economy via payment of entrance fees and visits to shops and restaurants in Gibraltar Town. The Government of Gibraltar collects the entrance fees to the Nature Reserve, a small portion of which is returned to GONHS as a contract fee for management, with the remaining funds diverted for other Governmental use. The taxi and coach operators also derive a large amount of money from the tourists (Perez and Bensusan 2005).

Visitors to the macaque sites currently receive little information on the macaques or on the history of nature reserve. However, GONHS recently (2006) completed an

informational booklet about the reserve and their website contains a wide variety of information about the macaques and other fauna and flora of Gibraltar.

Discussion

Qualitative Assessments of Macaque Tourism: Commensalism and Conflict

Local organizations that are concerned with the health and behavior of macaques and tourists actively manage both sites, which are characterized by patterned, but distinct, interactions between monkeys and tourists (Fuentes 2006a). In Bali and Gibraltar the sites contribute significantly to local economies and, there are low-scale conflicts between local human inhabitants and the macaques. The macaque populations began to increase as management teams professionalized, which appears to be directly related to the standardization of provisioning that involves both a diverse array and a substantial amount of food.

Despite the broad similarities, the qualitative assessment indicates important differences in areas of conflict (health risk, aggressive interaction patterns), commensalism (financial impact for humans, provisioning macaques), and in local human perspectives on the macaques. The differences at the sites illustrate variation in behavioral, economic, and cultural contexts as well as their potential impact on management strategies and options.

The directionality and severity of potential pathogen transmission between macaques and humans differ between the sites. At Padangtegal, both macaques and humans are at risk of potentially dangerous pathogen transmission from each other. The macaques in Bali have a high prevalence of simian enzootic infectious agents (Engel *et al.* 2002; Jones-Engel *et al.* 2005), and the majority of tourists visiting the site have arrived from another continent with a distinct environment frequently >5000 miles away in a temperate climactic zone of either the Northern (Europe, China, Japan) or Southern (Australia) hemispheres. Hence both the macaques and a majority of the human tourists are potentially immunologically naive relative to each other's endemic infectious agents and thus the risks of pathogenic transmission are higher. At another macaque tourist site in Bali (Sangeh), Jones-Engel *et al.* (2005) reported on the first documented transmission of a simian enzootic infectious agent (Simian foamy virus) to a human in Asia. At the same site, a significant outbreak of tuberculosis occurred in the macaque population in 2002, suggesting bidirectional pathogenic exchange at monkey tourist sites in Bali. However, there is no record of such instances at Padangtegal and the management at the site was far more efficient and engaged than their counterparts at Sangeh prior to 2005 (Fuentes *et al.* 2005), suggesting that management style may impact the level of potential pathogenic transmission.

In Gibraltar, there are very low levels of simian enzootic infectious agents in the macaques and no history of transmission to humans (GONHS, *unpublished data*). However, ≥ 2 potentially human-to-macaque pathogenic transmissions, i.e., gastroenteritis and pneumonia resulting in mortality among the macaques, have occurred (Fa 1992; O'Leary and Fa 1993). The Gibraltar macaques are potentially at greater risk from human pathogens and there is no possibility for natural gene flow from

other macaque populations to occur. Therefore, given the closed nature of the gene pool, though an epidemic poses no threat for other populations of *Macaca sylvanus*, it represents a potentially large-scale danger for the population at the site. However, the majority of visitors to Gibraltar are from the European Union (particularly Western Europe, the same biogeographic region as Gibraltar) and, unlike at Padangtegal, relatively similar environments. Therefore, the risk of novel endemic human pathogens is low and the long-term exposure by a small number of macaques to hundreds of thousands of regional humans annually may also have acted to increase their immunity to the local and regional human-borne pathogens.

Tourist interactions are superficially similar at both sites: tourists visit macaques and feed or otherwise interact with them. However, differences in human and macaque behavior may translate to substantially different levels of conflict for the 3 species involved. Padangtegal has higher rates of biting than Gibraltar (11.4% vs. 1.2% of aggressive interactions), and the macaques in Gibraltar appear more tolerant of humans touching and physically interacting with them. Padangtegal macaques responded with physical aggression (hitting, biting, lunging with contact) directed at humans in 78% of 420 aggressive interactions, whereas the Gibraltar macaques responded with physical aggression in 58% of 808 aggressive interactions and bit less frequently (Fuentes 2006a). At both sites macaques have frequent, close contact with a larger number of humans but Padangtegal macaques are more likely to engage in a fluid exchange (biting) with humans than Gibraltar macaques are. The health conflict arising from interactions is potentially more deleterious to the Gibraltar macaques than to the Padangtegal macaques, and the health conflict may be more serious for the humans at Padangtegal than at Gibraltar. In addition, at both sites extensive signage forbidding interactions and warning of their dangers appears not appear to inhibit tourists from interacting with them.

Another conflict may be that human visitors are impacting ranging patterns of the macaques in both Bali and Gibraltar, as they do at Mt. Emei (Zhao 2005), but to date there are insufficient data to determine the directionality and severity of this mode of impact. Initial data suggest that human density may not affect the macaques in Gibraltar in a simple or linear sense. Based on a preliminary sample of 373 interactions at 2 sites in Gibraltar (Ape's Den and Prince Philip's Arch) there is no significant difference in the rate or severity of aggression or frequency of contacts relative to mean human density, which ranged from 1 to >100 individuals, at each site (Fuentes 2006b).

Specific differences in aggressive behavior between *Macaca fascicularis* and *M. sylvanus* may play a role in the differences (Fuentes 2006a; Fuentes and Gamelr 2005). Frequency of aggression or the tendency to respond aggressively, including biting, may be higher in the more despotic *Macaca fascicularis* than in the less hierarchical *M. sylvanus* (Thierry 2000). However, local structural and ecological, as well as historical, differences between the sites are also likely explanatory factors for the different interaction patterns (Zhao 2005).

Because the Gibraltarians and Balinese are distinct culture groups one expects cultural differences to be reflected in the management and interaction patterns. In Bali, macaques are not sacred but are relatively well treated, and protected, in temple forest areas and are largely tolerated by the local populace (Fuentes *et al.* 2005; Loudon *et al.* 2006). Monkeys play a significant role in Balinese history and popular

mythology even though the inhabitants may treat them as pests during crop raiding (Fuentes *et al.* 2005; Loudon *et al.* 2006). In Gibraltar, many locals see the macaques as pests and are actively calling for removal or culling of some segment of the population (Cortes and Shaw 2006). Though macaques have a place in Gibraltar history (Perez and Bensusan 2005; Shaw and Cortes 2006), they are not as tolerated or integrated into daily life as in Bali. One segment of the Gibraltar population, taxi and coach drivers, has a strong affinity for the macaques and acts to maintain the status quo in regard to access and interactions with them. Because their income is largely dependent on access to them, they have a vested interest in facilitating tourist visits to the macaque interaction sites. The differing perspectives in Bali and Gibraltar result in differential public and political pressures on the management teams as they attempt to manage tourist experiences and populations of macaques. Cultural differences between tourists visiting the sites may also add to the patterns (Fuentes 2006a).

At both locations, tourist dollars are important to the economies of the surrounding human communities and macaque tourism is a main source of tourist-generated income. One can see this as commensalism (mutual benefit) because the influx of tourist monies/revenues contributes to the provisioning and protection of the macaques because at least some of the entrance fees are returned to managers to purchase food for them and to the local human populations via income. However, the benefit for humans is distinct in Bali and Gibraltar because the patterns of control of touristic revenue differ. At Padangtegal, the village keeps the majority of the income generated by tourists (entrance fees) and the village council distributes it for infrastructural and religious events and to the management committee as an operational budget. A small percentage of the entrance fees go to the regional, provincial, and federal governments in the form of taxes.

In Gibraltar, the entrance fees go directly to the central government, which provides a very small stipend for management of the macaques and some infrastructural support for the reserve: road maintenance, water, and electricity maintenance. The vast majority of the income that macaque tourism generates in Gibraltar stays with the Gibraltar government and the privately owned taxi and coach services instead of being returned to the group responsible for macaque management (GONHS).

The absolute amount of money visitors to the Upper Rock Nature Reserve generates dramatically outstrips the amount Padangtegal tourists generate, but the actual return to the management bodies is relatively higher at Padangtegal. Combined with the fact that Gibraltar is a relatively sovereign state (a territory, belonging to the United Kingdom, but with considerable self-government) whereas Padangtegal is a village in a province of Indonesia suggests that the economic stakes are higher for the human stakeholders in Gibraltar than in Bali. That is, the government of Gibraltar and the individuals running the taxi and coach companies gain more direct financial benefit from macaque tourism than does the government or tour operators of Bali. There are only 3 coach companies and *ca.* 130 individual taxi licenses in Gibraltar and many more such companies in Bali, which may result in very different impacts in the ways in which the sites can be managed and the relative power that managers have in controlling the pace, patterns, and context in which tourists visit the macaques.

Brief Comparison with Mt. Emei: A Third Macaque Tourist Site

At Mt. Emei, China, Zhao and colleagues have amassed a substantial dataset regarding the commensalism and conflict between *Macaca thibetana* and humans. Similarities between Mt. Emei and Padangtegal include the fact that humans arrive at the site for religious purposes (Buddhist at Mt. Emei and Hindu at Padangtegal), that local humans at the site interact regularly with the macaques, and that tourists carrying of food is the main stimulus for interactions —frequently conflicts— as macaques seek out such human visitors. Gibraltar and Mt. Emei have less in common but both are located on potentially dangerous cliffs and the macaques have similar body sizes, larger than Padangtegal macaques. Important differences between the 2 sites and Mt. Emei are that at Mt. Emei there is not substantial organized, year-round provisioning of the macaques and the local population, while generating some income via guides and photographers, receives no substantial monetary benefit despite charging an admission fee to visitors (Zhao 2005). Also, at Mt. Emei at ≥ 10 human deaths have occurred as a result of interactions with the macaques, mainly to from falling off cliffs (Zhao 2005), whereas none has occurred at Padangtegal or Gibraltar. Also at Mt. Emei the management staff is reluctant to inform tourist/pilgrims about the dangers of macaque-related problems (Zhao 2005).

Adding Mt. Emei to the comparison emphasizes the management importance of tourists carrying food and local human initiation of interactions. At all 3 sites, the food tourists bring appears to be the prime stimulus for macaque-tourist interactions. At Gibraltar and Mt. Emei, local humans increase interactions by acting as guides and encouraging interactions in the hopes of economic benefit from the tourists. The 2 factors are among the core management issues facing macaque tourism site managers (Fuentes and Gamerl 2005; Zhao 2005).

Qualitative Assessment of Macaque Tourism Matters to Primatologists

Human cultural patterns and economics as well as macaque species' differences play substantial roles at macaque tourism sites. Including qualitative assessments of the relationships between macaques and humans can improve our understandings of the sites. Zhao (2005) suggested that we envision an ecosystem wherein the interface between humans and macaques is best understood by integrating behavioral, historical, cultural, demographic, economic, and management factors at macaque tourist sites (Zhao 2005, Fig. 6). Is such an approach valuable to primatology? We suggest that the situations at Padangtegal and Gibraltar add support to the case of Mt. Emei and answer in the affirmative. Cultural and historical issues clearly impact interaction patterns and management possibilities, and the issues are directly tied into economic issues at both sites. Their behavior, demography, and disease patterns are tied to the human-macaque interactions, which are affected by the management of the sites and the perceptions and patterns of the locals and tourists visiting them. In macaque tourism populations, their ecology and behavior are connected to the patterns of human cultural variation and management. Therefore, assessing the behavior and ecology of macaques at the sites requires including anthropogenic variables as normative constituents of the ecosystem. While the distribution of food

trees and soil structure can influence the feeding and ranging of macaques, so to do the politics and economics of the local human populations.

We must incorporate human contexts —tourist flow, interaction patterns, modification of the habitat, cultural patterns in area use— as elements in data collection in studies of macaques if we wish to understand their ecology and behavior. Macaques intersect in complex ways with local economies, politics, and people's daily lives, such that our data, and the manner in which we present it, can influence a diverse array of people in a varying manners. We should therefore always attempt to work in concert with the managers/administrators of macaque tourist sites in attempts to integrate the academic and applied elements from data collection projects.

Conclusions

Informed management requires an engaged understanding of a broad ecology. At macaque tourism sites the ecology includes the commensalism and conflicts (*sensu* Zhao 2005) between local people and tourists with the macaques. Different cultural contexts and patterns of interactions between humans and macaques can result in differential management challenges across sites, especially in disease transmission and economic contexts. Thus research agendas in the areas must include qualitative assessments such as those we have reported, and quantitative measures (Fuentes and Gamerl 2005; Zhao 2005).

Across the sites, patterns of similarity emerge, such as the high frequency of physical contact, the role of locals in initiating interactions, and the role of tourist feeding of the macaques. Increased management efficiency, including provisioning efficiency, can also result in increasing population sizes for the macaques, which in turn may create novel management conflicts. An integration of research and management at macaque tourism sites must take place to construct a satisfactory set of recommendations and conclusions regarding macaque tourism on the whole. Studies must be conducted with all stakeholders in mind and using formal protocols, both qualitative and quantitative, to gain true insight into the ecology, behavior, and sustainability at macaque tourist sites.

Acknowledgments We thank the management and staff of the Padangtegal Wenara Wana, especially Pak Selamat, the Center for Primate Studies and University Udayana, Bali, Indonesia; Dr. A. L. T. Rompis; and the staff of the UNUD-PKP, the GONHS staff, especially Dale Lageua and Damien Holmes; and the participants of the Bali Macaque Project and Gibraltar research teams. The University of Notre Dame Institute for Scholarship in the Liberal Arts and the Office of the Dean of the College of Arts and Letters partially supported the research. Funding for work at Padangtegal came in part from the Central Washington University Office of International Programs and Primate Conservation, Inc. We also thank Dr. Qi-Kun Zhao and 1 anonymous reviewer for insightful commentary on earlier versions of the manuscript.

References

- Aggimarangsee, N. (1992). Survey of semi-tame colonies of macaques in Thailand. *Natural History of Siam Bulletin*, 40, 103–166.
- Alvarez, L. (2005). Where the British may reign but the monkeys rule. *New York Times*, May 28, 2005.

- Beranek, K., & Fuentes, A. (2004). Cross species communication? Video analysis of human-monkey interactions. *American Journal of Physical Anthropology*, 38(Suppl.), 62–63.
- Berman, C., Ionica, C., Li, J., Yin, H., & Ogawa, H. (in press). Primate tourism, range restriction and infant risk among *Macaca thibetana* at Mt. Huangshan, China. *International Journal of Primatology*.
- Burton, F. D., & Sawchuk, L. A. (1984). The genetic implication of effective population size for the Barbary macaque in Gibraltar. In J. E. Fa (Ed.), *The barbary macaque: A case study in conservation* (pp. 307–318). New York: Plenum Press.
- Cortes, J., & Shaw, E. (2006). The Gibraltar macaques: Management and future. In K. Hodges & J. Cortes (Eds.), *The Barbary Macaque, biology, management and conservation* (pp. 199–210). Nottingham: University of Nottingham Press.
- Engel, G. A., Jones-Engel, L., Suaryana, K. G., Arta Putra, I. G. A., Schilliaci, M. A., Fuentes, A., et al. (2002). Human exposures to herpes B seropositive macaques in Bali, Indonesia. *Emerging Infectious Disease*, 8, 789–795.
- Fa, J. E. (1984). Structure and dynamics of the Barbary macaque population in Gibraltar. In J. E. Fa (Ed.), *The Barbary Macaque: A case study in conservation* (pp. 263–306). New York: Plenum Press.
- Fa, J. E. (1992). Visitor-directed aggression among the Gibraltar macaques. *Zoo Biology*, 11, 43–52.
- Fa, J. E., & Lind, R. (1996). Population management and viability of the Gibraltar Barbary Macaques. In J. E., Fa & D. J. Lindburg (Eds.), *Evolution and ecology of macaque societies* (pp. 235–262). Cambridge, U.K.: Cambridge University Press.
- Fuentes, A. (2006a). Human culture and monkey behavior: Assessing the contexts of potential pathogen transmission between macaques and humans. *American Journal of Primatology*, 68, 880–896.
- Fuentes, A. (2006b). Patterns and context of human-macaque interactions in Gibraltar. In K. Hodges & J. Cortes (Eds.), *The Barbary Macaque, biology, management and conservation* (pp. 169–184). Nottingham: University of Nottingham Press.
- Fuentes, A., & Gamel, S. (2005). Disproportionate participation by age/sex class in aggressive interactions between long-tailed macaques (*Macaca fascicularis*) and human tourists at Padangtegal Monkey Forest, Bali, Indonesia. *American Journal of Primatology*, 66, 197–204.
- Fuentes, A., Harya Putra, I. D. K., Suaryana, K. G., Rompis, A., Artha Putra, I. G. A., Wandia, N., et al. (2000). The Balinese Macaque Project: Background and stage one field school report. *Jurnal Primatologi Indonesia*, 3, 29–34.
- Fuentes, A., Southern, M., & Suaryana, K. (2005). Monkey forests and human landscapes: Is extensive sympatry sustainable for *Homo sapiens* and *Macaca fascicularis* on Bali? In J. Patterson (Ed.), *Commensalism and conflict: The primate-human interface* (pp. 168–195). Norman, OK: American Society of Primatology Publications.
- Fuentes, A., & Wolfe, L. D. (2002). *Primates face to face: The conservation implications of human-nonhuman primate interconnections*. Cambridge University Press, Cambridge, U.K.
- Honey, M. (1999). *Ecotourism and sustainable development: Who owns paradise?* Island Press, Washington, D.C.
- Jones-Engel, L., Engel, G., Schilliaci, M. A., Rompis, A. L. T., Putra, A., Suaryana, K., et al. (2005). Primate to human retroviral transmission in Asia. *Emerging Infectious Diseases*, 7, 1028–1035.
- Loudon, J., Howell, M., & Fuentes, A. (2006). The importance of integrative anthropology: A preliminary investigation employing primatological and cultural anthropological data collection methods in assessing human-monkey co-existence in Bali, Indonesia. *Environmental and Ecological Anthropology*, 2, 2–13.
- Matheson, M. D., Sheeran, L. K., Li, J. H., & Wagner, R. S. (2006). Tourist impact on Tibetan Macaques. *Anthrozoos*, 19, 158–168.
- O’Leary, H., & Fa, J. E. (1993). Effects of tourists on Barbary macaques at Gibraltar *Folia Primatologica*, 61, 77–91.
- Patterson, J., & Wallis, J. (eds.) (2005). *Commensalism and Conflict: The Primate-Human Interface*. American Society of Primatology Publications, Norman, OK.
- Perez, C. E., & Bensusan, K. J. (2005) *Upper Rock Nature Reserve: A management action plan*. Gibraltar Ornithological and Natural History Society, Gibraltar.
- Shaw, E. & Cortes, J. (2006). The Gibraltar macaques: Origin, history and demography. In K. Hodges & J. Cortes (Eds.), *The Barbary Macaque, Biology, Management and Conservation* (pp. 185–198). Nottingham: University of Nottingham Press.
- Stephenson, R. A., Kurashina, H., Iverson, T. J., & Chiang, L. N. (2002). Visitors’ perceptions of cultural improprieties in Bali, Indonesia. *Journal of National Parks*, 12, 156–169.
- Thierry, B. (2000) Covariation of conflict management patterns across Macaque species. In F. Aureli & F. B. M. De Wall (Eds.), *Natural Conflict Resolution* (pp. 106–128). Berkeley: University of California Press.

-
- Wallis, J., & Lee, D. R. (1999). Primate conservation: the prevention of disease transmission. *International Journal of Primatology*, 20, 803–825.
- Wheatley, B. P. (1999). *The sacred monkeys of Bali*. Waveland Press, Long Grove, IL.
- Wheatley, B. P., & Harya Purta, D. K. (1994). Biting the hand that feeds you: Monkeys and tourists in Balinese monkey forests. *Tropical Biodiversity*, 2, 317–327.
- Wilson, E. O. (1975). *Sociobiology: The New Synthesis*. Cambridge: Belknap Press.
- Wolfe, L. D. (1991). Macaques, pilgrims, and tourists re-visited. *National Geographic Research & Exploration*, 7, 241.
- Wolfe, L. D. (2002). Rhesus macaques: A comparative study of two sites, Jaipur, India and Silver Springs, Florida. In A. Fuentes & L. D. Wolfe (Eds.), *Primates face to face* (pp. 310–330). Cambridge, U.K.: Cambridge University Press.
- Woodford, M. H., Butynski, T. M., & Karesh, W. B. (2002). Habituating the great apes: The disease risks. *Oryx*, 36, 153–160.
- Zhao, Q. K. (1991). Macaques and tourists at Mt. Emei, China. *National Geographic Research & Exploration*, 7, 115–116.
- Zhao, Q. K. (2005) Tibetan macaques, visitors, and local people at Mt. Emei: Problems and countermeasures. In J. Paterson (Ed.), *Commensalism and conflict: The human-primate interface*. (pp. 376–399) Norman, OK: American Society of Primatologists.