



Factors Predicting Provisioning of Macaques by Humans at Tourist Sites

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Received: 17 July 2019 / Accepted: 24 February 2020 / Published online: 20 April 2020
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Abstract

Incidental primate tourism is prevalent in many primate habitat countries. In these scenarios, although the primary motivation of the tourists may not be to interact with primates, they may do so because of the presence of primates in tourist spots. Provisioning of primates is a common behavior that humans engage in at these sites. While several studies have assessed the impact of tourism or provisioning on primates, understanding why humans provision and its sociocultural predictors are primary requirements for designing primate management and/or conservation plans. We assessed these issues using questionnaire surveys at two sites where people provision macaques in India: in Himachal Pradesh and Goa ($N = 203$). People were driven to feed macaques by the desire to observe them closely, concern over decreasing food resources for wildlife, and religious affinities. The best model for Goa included age, gender, religion, and education as predictors of whether respondents provisioned; people with religious affinities apart from Hinduism were *ca.* 24 times as likely to provision as Hindus, and respondents with the highest level of education were 54 times as likely to provision as those with the lowest. At Himachal Pradesh, the best model contained religion and education as predictors. The trend was the reverse of that at Goa; people following Hinduism and those with lower education were more likely to provision. Our results show that no singular template is suitable for managing human–primate interactions across sites. We suggest more studies involving diverse sites be conducted to assess region-specific issues for ensuring human–primate coexistence.

Keywords Bonnet macaque · Incidental tourism · India provisioning · Resident-tourist · Rhesus macaque

Handling Editor: Joanna M. Setchell

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s10764-020-00148-5>) contains supplementary material, which is available to authorized users.

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Introduction

Primate tourism is a form of human–primate interface that has garnered much attention from primatologists (Fuentes *et al.* 2007). It includes ape tourism that involves safari-like expeditions to remote areas to watch apes in their natural habitats as nonintrusively as possible (Matheson 2017). In many countries across Asia, primate tourism involves the formation of designated “monkey parks” wherein primate ranging is restricted by the strategic placement of feeding stations (Russon and Wallis 2014). In many primate habitat countries, though, the most common form of primate tourism is incidental (Grossberg *et al.* 2003). In these scenarios, although the primary motivation of the tourists may not be to interact with primates, they may do so because of the presence of groups of common primate species in tourist spots such as cultural and archaeological sites (Grossberg *et al.* 2003). Examples include populations of macaques, langurs, or baboons that abound in tourist destinations such as public parks and popular recreational locations (Brotcorne *et al.* 2017; Medhi *et al.* 2007).

Feeding primates or provisioning is one of the most common forms of interactions that people engage in at monkey parks or at incidental tourist sites (Brotcorne *et al.* 2017; Marty *et al.* 2019; Unwin and Smith 2010). In both cases, since primate ranging patterns are not artificially restricted by food, the effects of human–primate interactions may go beyond the tourism site and into adjoining residential areas. For instance, primates that are used to being provisioned by tourists may seek anthropogenic food by directly begging from residents of the area or by foraging for food in their kitchens or garbage dumps (Unwin and Smith 2010). Provisioned groups of primates are also often more aggressive than their nonprovisioned counterparts, which may generate negative perceptions of primates by humans (Matheson *et al.* 2006). Incidental primate tourism is thus very relevant for the discipline of “ethnoprimateology,” which views humans and primates as coparticipants within integrated socio-ecological spaces wherein they mutually influence each other’s lives (Sponsel 1997).

Ethnoprimateology advocates assessments of human–primate interfaces from both the human and primate perspectives (Fuentes *et al.* 2007; Hockings *et al.* 2010). While several studies have assessed the impact of tourism or provisioning on primates, understanding the reasons why humans engage in provisioning is a primary requirement for designing effective human–primate coexistence strategies in these scenarios (Priston and McLennan 2013). People’s attitudes toward wildlife are a function of aspects of their sociocultural identities such as gender, ethnicities, economic and educational backgrounds, and religious practices (Dickman 2010). For example, in the case of tourists from Western countries, provisioning wildlife is attributed to their urge to interact with exotic animals that are not found in their own nations (Orams 2002). In contrast, in South and Southeast Asia, provisioning animals is often driven by religious underpinnings (Knight 1999). An assessment of these sociocultural factors underlying human–primate interactions is thus crucial in devising appropriate primate conservation plans (Humble and Hill 2016).

With this background, we assessed the reasons why tourists and residents provisioned primates at two incidental primate tourism sites: Dudhsagar Waterfalls in Mollem National Park and its vicinity in Goa, India (Mollem henceforth), and Jakhoo Temple, Shimla, Himachal Pradesh, India. Bonnet macaques (*Macaca radiata*) are found at the former, and the latter is home to rhesus macaques (*M. mulatta*). We also evaluated which sociocultural factors were the predictors of humans engaging in provisioning behavior.

More highly educated people may have come across information on the negative consequences of provisioning that would deter them from engaging in the practice. Thus, we asked (a) does level of education have an influence on whether or not people engaged in provisioning? The Hindu epic *Ramayana* describes the feats of the monkey god Hanuman who aids king Rama in defeating the demon-king Ravana, and people practicing Hinduism ascribe a godly status to monkeys (Priston and McLennan 2013). Thus, we asked (b) do Hindus provision macaques more in comparison with people with other religious affinities? While landscape characteristics are the determinants of the location of human–wildlife interactions, social factors such as age and gender determine emotional responses of humans toward wildlife (Kretser *et al.* 2009; Treves *et al.* 2004). So we asked (c) do age and gender influence whether people engage in provisioning? Finally, we aimed to assess the level of understanding that tourists and residents had of the negative impacts of provisioning primates.

Methods

Study Area

Mollem

We conducted this part of the study between March and May 2012. Spread over an area of 107 km², Mollem (Fig. 1) is located at the core of the Bhagwan Mahaveer Wildlife Sanctuary (BMWS) and is characterized by diverse vegetation types. BMWS is situated between 15°14′09.82″N and 15°22′51.57″N and 74°09′47.79″E to 74°20′02.92″E (Gad and Shyama 2009). Altitude within the park ranges from 80 to 750 masl; temperatures vary between 15°C and 37°C (Datar and Lakshminarasimhan 2013). The mean annual rainfall amounts to 2400 mm (Gad and Shyama 2009).

The Dudhsagar waterfalls, located in Mollem, is a major tourist attraction. Bonnet macaques, which have a broad dietary niche, can adapt to a range of habitats, and thrive in anthropogenic landscapes, are found in large numbers in this area (IUCN 2018; Richard *et al.* 1989). Although feeding the macaques is prohibited at the Dudhsagar falls, visitors still do so. Visitors usually hire jeeps to visit the falls (located 16 km away from the Collem gate of the National Park). The jeep drivers often encourage the visitors to buy fruits and vegetables from the local market for the macaques before embarking on the ride (Author 1, personal observations). Bonnet macaques forage in crops in the villages bordering Mollem (Sengupta and Radhakrishna 2013).

Jakhoo

We conducted this part of the study in October 2018. Jakhoo Temple is located between 31°06′04″N and 77°10′55″E at an altitude of 2455 m and is dedicated to the monkey god Hanuman. The temple is located on a hill in the midst of a forested area and rhesus macaques are commonly present within the temple precincts (Fig. 2).

Rhesus macaques have the largest geographic range among primates in India. They have a flexible diet and can adapt to different habitats and thrive in anthropogenic environments. Human–rhesus macaque conflict in the form of crop-foraging in rural

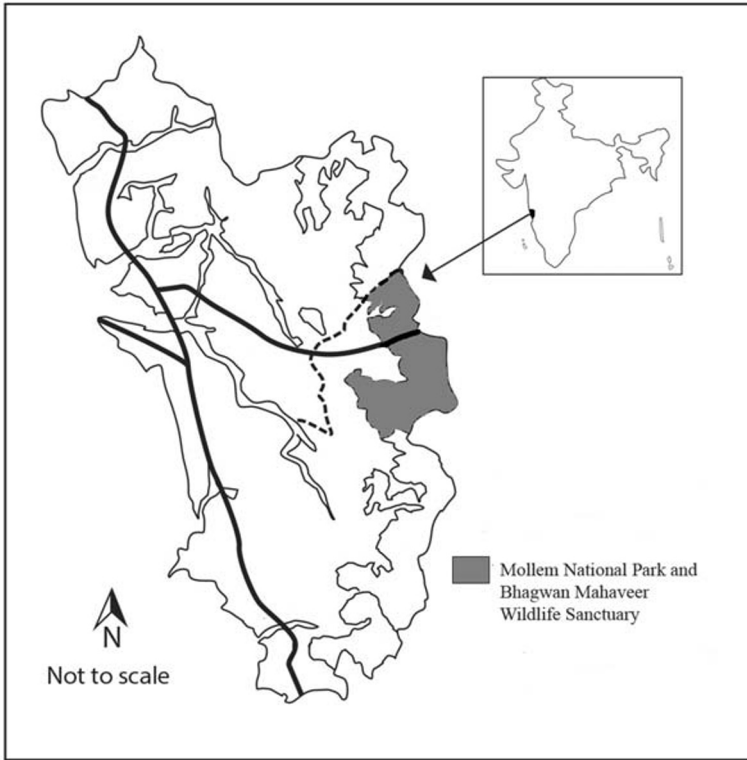


Fig. 1 Location of Mollem National Park and Bhagwan Mahaveer Wildlife Sanctuary (inset showing location of Goa within India). Source: A. Sengupta and S. Radhakrishna (2013).

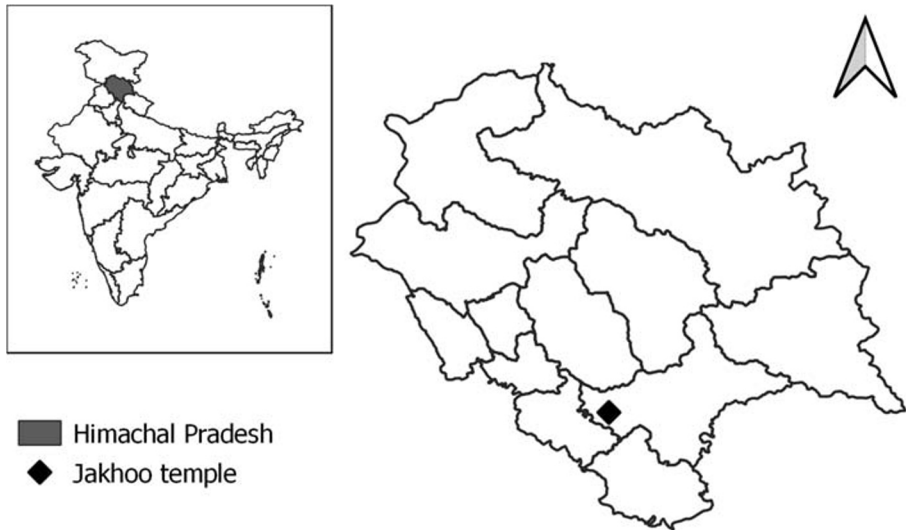


Fig. 2 Location of Jakhoo Temple in Himachal Pradesh (inset showing location of Himachal Pradesh within India).

areas, and house-raiding and harassment by macaques in urban areas, are serious concerns across Himachal Pradesh and is especially severe in the city of Shimla (Chauhan and Pirta 2010). The government has instituted several measures, including sterilization, banning provisioning, and shooting of macaques to mitigate conflict intensities. However, these efforts have seen limited success (Radhakrishna and Sinha 2011). Despite the ban on provisioning, visitors at Jakhoo Temple continue to feed macaques (Kaburu *et al.* 2018; Marty *et al.* 2019).

Questionnaire Surveys

We used a questionnaire to investigate if and why people provisioned macaques at the study sites. We used opportunistic sampling to select respondents for our study depending on whether people were willing to answer the questionnaire. We introduced ourselves to each respondent, informed them of the aims of our study, and asked the questions after obtaining their consent. The work conducted at Mollem was a part of a larger study addressing the distribution of bonnet macaques in Goa and people's attitudes toward and perceptions of bonnet macaques (Sengupta and Radhakrishna 2013). At Mollem, we interviewed 103 people: 50 residents and 53 tourists (Table I). Since most of the tourists were not Indians, we asked their tour guides (who spoke the language of the foreign nationals and English) to explain the aims of our study to them and also translate the questions and responses. We were accompanied by a local forest guard when we interviewed the residents; he introduced us, explained the purpose of our study in the local language (Konkani), obtained their consent to be interviewed, and acted as translator/interpreter whenever necessary.

At Jakhoo, we interviewed 100 people, 40 of whom were residents of Shimla and 60 were tourists (Table I). Since the majority of respondents here were Indian nationals and the foreign nationals understood English, we conducted the interviews in English and occasionally in Hindi with some of the Indian respondents. The first part of the questionnaire comprised questions about the socioeconomic status of the respondents, and the second part included questions related to provisioning (Table II).

Data Analyses

To identify the factors driving provisioning of macaques by the respondents, we used Generalized Linear Models (GLMs) in R version 3.5.1 (R Core Team 2018). We did our analyses separately for Mollem and Jakhoo. Our response variable was whether or not the respondents engaged in provisioning (0 = no provisioning, 1 = provisioning). Our predictor variables initially were age, gender, religion, level of education (Table III), and residence status (tourist or resident). We checked for association between predictor variables through Goodman and Kruskal's tau (τ) using the package GoodmanKruskal in R (Pearson 2016). Since residence had a high association with religion and level of education, we did not use it for further analyses. We used the residuals vs. fitted plot and the normal Q-Q plot respectively in R to check for homogeneity of variance and the distribution of residuals in our datasets. We built a set of *a priori* candidate models with different combinations of these predictors using a binomial error structure with logit link function (Electronic Supplementary Material [ESM] Table SI). We then analyzed and ranked the models based on second-order Akaike information criterion (AICc). Thereafter, using MuMIn in R, we

Table 1 Socioeconomic profiles of respondents at Mollem, Goa, India (March–May 2012) and Jakhoo Temple, Himachal Pradesh, India (October 2018)

Predictors	Categories	Mollem (no. of respondents)		Jakhoo (no. of respondents)	
		Resident	Tourist	Resident	Tourist
Age	20–30	11	22	5	22
	31–40	12	10	15	15
	41–50	12	9	12	9
	51–60	12	12	7	3
	>60	3		1	11
Gender	Man	30	21	36	52
	Woman	20	32	4	8
Religion	Hindu	47	8	38	45
	Other	3	45	2	15
Education	Level 1	40	3	7	1
	Level 2	1	10	17	5
	Level 3	9	40	16	54
Occupation	Farmer	12			
	Housewife	12		3	
	Government employee	12	10	7	15
	Laborer	8			
	Businessman	3		5	11
	Unemployed	3	6		
	Student		12		4
	Freelancer		20		
	Medical practitioner		5	2	1
	Bank employee			2	1
	Academic			1	5
	Hospitality sector employee			5	1
	Tour operator			4	2
	Private sector employee			4	6
	Informal sector employee			7	5
Engineer				7	
Lawyer				2	

The figures for Mollem have been published in Sengupta and Radhakrishna (2013)

averaged the best fit models ($\Delta\text{AICc} < 2$) to understand the influence of the predictors on whether the respondents engaged in provisioning. We did not use site (temple or other) as an interaction term because during model averaging, estimates of a main effect may be biased if a predictor is only a main effect in some models but also part of the interaction term in others. To understand effect sizes, we used two measures: we first checked for association between the response and each of the predictor variables with Goodman and Kruskal's tau (τ); this measure estimates the fraction of variability in variable y that is explained by variable x and vice versa—it is an asymmetric measure and the forward association may not

Table II Questionnaire used for the study at Mollem National Park, Goa, India (March–May 2012) and Jakhoo Temple, Himachal Pradesh, India (October 2018)

Demographic and socioeconomic variables	
Name of the respondent (anonymity will be maintained)	
Age	
Gender	
Religion	
Country of residence	
If Indian, resident/tourist	
Highest level of formal education	
Occupation	
Provisioning	
Do/have you feed/fed macaques?	
If yes/no, why do you/do you not feed them?	
Do you know of any negative impacts that provisioning can have on macaques?	

be the same as the reverse. It ranges between 0 and 1. We also calculated the odds ratio (ratio of the odds of event A happening in the presence of event B to that of A happening in the absence of B) as a measure of effect size for predictors in the best fit models that showed strong association with the response variable. We calculated odds ratios as the exponential of the coefficients for each of the predictors.

Ethical Note

The research methods complied with the ethics protocols specified by the Institutional Review Board of A. Sengupta's institute. We did not handle any animals during the study. We obtained informed consent from all the participants of the study and maintained anonymity. The authors declare that they have no conflict of interest.

Table III Predictors used in generalized linear models for assessing factors driving provisioning of rhesus and bonnet macaques at Mollem National Park, Goa, India (March–May 2012) and Jakhoo Temple, Himachal Pradesh, India (October 2018)

Predictors	Categories
Age	(Numeric predictor)
Gender	Man Woman
Religion	Hindu Other
Education	Educated to less than 10th grade (12 yr of formal education including 2 yr of kindergarten; level 1) 10th–12th grade (12th grade signifies 14 yr of formal education including 2 yr of kindergarten; level 2) Bachelor's degree and beyond (level 3)

Data Availability The data collected for and analyzed in this study is available from the corresponding author upon reasonable request.

Results

Mollem

At Mollem, only 10% of the resident respondents ($N = 5$) said that they provisioned primates. All of them were Hindus who said that they fed macaques because they represented the monkey god Hanuman. Respondents who did not provision macaques said that macaques should never be fed, as that would increase the probability of macaques destroying their crops, gardens, or kitchens. When asked about the negative consequences of provisioning, 22% of the villagers ($N = 11$) said that they did not know of any, 12% ($N = 6$) said that it heightened the chance of bidirectional disease transmission, and 66% ($N = 33$) said that provisioning would lead to heightened conflict between people and macaques with respect to crop damage.

The countries represented by the tourist respondents included Russia ($N = 18$), France ($N = 9$), the United States ($N = 13$), the United Kingdom ($N = 5$), and India ($N = 8$; Table I). All the tourist respondents said that they fed macaques. Eighty percent ($N = 42$) of these respondents said that they did so to see the macaques from closer quarters; 10% ($N = 5$ respondents) said they did so because they loved wildlife while the remaining 10% ($N = 6$) said that they were guided by their religious beliefs. Ninety percent ($N = 48$) of the tourist respondents seemed to be unaware of any negative impacts of provisioning on macaques. Only 10% (5, all of whom were Indians) suggested that conflict over shared resources such as crops may increase in villages because the macaques were used to getting food from people.

As for factors predicting provisioning by people at Mollem, the average model (combining the two models with $\Delta \text{AICc} < 2$) contained the following parameters: age, gender, education, and religion (Table IV). The associations between provisioning and religion and between provisioning and education were strong (Fig. 3). Odds ratios showed that people with religious affinities apart from Hinduism were 24 times more likely to engage in provisioning than Hindus at Mollem. Respondents with level 3

Table IV Model-averaged coefficients of predictors of provisioning of bonnet macaques by people at Mollem, Goa, India (March–May 2012)

Parameters	Estimate	Standard error	Z-value
Intercept	4.69	2.59	1.80
Age	0.04	0.05	0.80
Gender: man	0.61	0.90	0.67
Religion: other	3.17	1.02	3.08
Education: level 2	1.44	1.55	0.92
Education: level 3	3.99	0.89	4.43

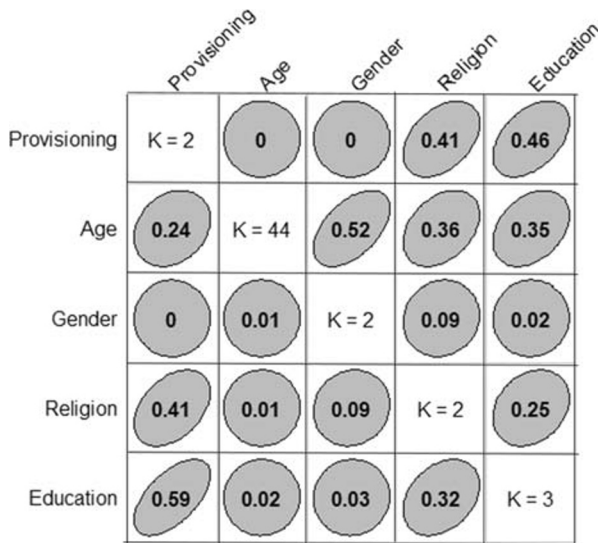


Fig. 3 Association between provisioning of bonnet macaques (response variable) and predictor variables at Mollem, Goa, India (March–May 2012). K is the number of levels within each predictor. Off-diagonal elements contain the forward and backward measures of association (τ) between each pair of predictors.

education were 54 times more likely to engage in provisioning than those with level 1 education and 13 times more than those with level 2 education.

Jakhoo

At Jakhoo, 85% of the residents ($N = 34$) said that they provisioned macaques. Most of the residents who provisioned macaques were guided by their religious beliefs in doing so ($N = 19$; 56%). The remaining residents said that they provisioned macaques because they believed monkeys are our ancestors ($N = 2$; 6%), monkeys would die of starvation otherwise ($N = 4$; 12%), and it was fun watching monkeys eat ($N = 2$; 6%). One respondent also said that it made taking selfies with monkeys easier. While 6% ($N = 2$) of respondents said that they provisioned the macaques to get rid of their excess food to prevent waste, 12% ($N = 4$ respondents) said though they did not want to feed the macaques, the latter’s aggressive behavior forced them to do so. All six residents (15%) who refrained from feeding macaques did so because they believed it caused the macaques to become more aggressive. When questioned about the negative impacts of feeding primates, 19 resident respondents (47%) said that they were aware of them. While 16 (84%) of these residents said supplemental feeding of primates can make the latter hyperaggressive and subsequently cause higher conflict with humans, three said that there was a chance of bidirectional disease transmission.

The countries represented by our tourist respondents were as follows: India ($N = 49$), England ($N = 5$), Australia ($N = 3$), Argentina ($N = 1$), Sweden ($N = 1$), and the Netherlands ($N = 1$). The overall education level of the tourists was much higher than that of the residents and included 21 master’s and 3 doctoral degree holders. Only 55% of tourists ($N = 33$) provisioned macaques. Nineteen of the 33 tourists (58%) who fed macaques were also guided by their religious beliefs in feeding the macaques. Similar

Table V Model-averaged coefficients of predictors of provisioning of rhesus macaques by people at Jakhoo temple, Himachal Pradesh, India (October 2018)

Parameters	Estimate	Standard error	Z-value
Intercept	< 0.001	1.41	0.00
Religion: other	-1.03	0.92	1.11
Education: level 2	1.62	1.76	0.92
Education: level 3	-0.73	1.44	0.50

to the residents, the other reasons included the belief that monkeys are our ancestors ($N = 1$; 3%), concern over their potential starvation due to forest depletion ($N = 9$; 27%), and entertainment ($N = 4$; 12%). Ten of the 27 tourists who did not provision (37%) said that the practice caused hyperaggression in macaques. The remaining respondents said they felt that they should not interfere with the macaques' natural ecology. In addition, they felt anthropogenic food was bad for wildlife. Sixty-eight percent of the tourists ($N = 41$) were aware of the deleterious effects of provisioning; 59% ($N = 35$) were concerned about heightened conflict and the remaining were worried about interspecies disease transmission.

For Jakhoo, the average model for understanding the factors driving provisioning of primates by humans contained the following parameters: education and religion (Table V). Here the trend was opposite to that at Mollem: respondents with "other" religious affinities engaged in provisioning less and so did those with the highest level of education (Table V). The associations between provisioning and all the predictor variables were weak (Fig. 4). People with level 3 education were 0.48 times as likely to

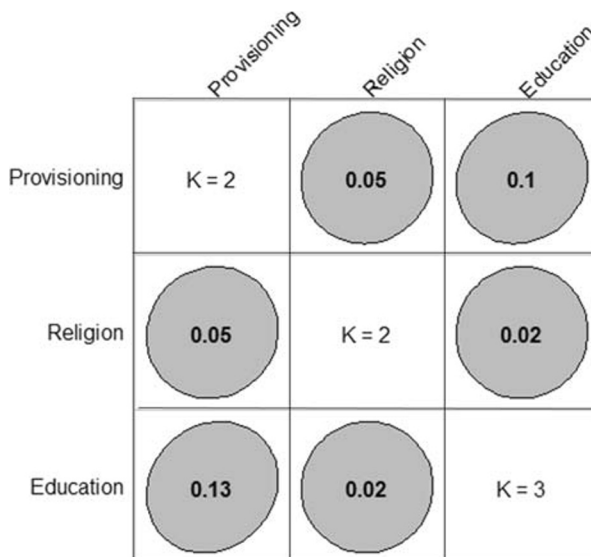


Fig. 4 Association between provisioning of rhesus macaques (response variable) and predictor variables at Jakhoo temple, Himachal Pradesh, India (October 2018). K is the number of levels within each predictor. Off-diagonal elements contain the forward and backward measures of association (τ) between each pair of predictors.

provision as those with level 1 education. People following faiths apart from Hinduism were 0.36 times as likely to feed macaques as the Hindu respondents.

Discussion

Our findings suggested that most people at our study sites are motivated to provision primates because they enjoy watching monkeys from close quarters, are concerned about the lack of food for wildlife, and due to religious affinities. The best fit model at Mollem for predicting whether people would engage in provisioning had age, gender, education, and religion as predictors. The one for Jakhoo contained only education and religion.

At Mollem, the association between provisioning and age as well as that between provisioning and gender were weak. The finding that the gender of the respondents is not a significant predictor for engaging in provisioning should be treated with caution because of the low representation of women among respondents at both the sites. The same caution should be exercised with regard to age, as there was also very low representation of the highest age category in our sample. Both gender and age are predictors of human attitudes towards wildlife in other studies (Reynolds and Braithwaite 2001).

The association between provisioning and education was strong at Mollem. Respondents with the highest education levels were 54 times as likely to provision macaques as those with the lowest education levels. In contrast, at Jakhoo, respondents with the highest education levels provisioned less, but the effect size was much lower. People with religious affinities apart from Hinduism engaged significantly more in provisioning at Mollem. Respondents following religious faiths apart from Hinduism were ca. 24 times as likely to engage in provisioning as Hindu respondents at Mollem. Although religion did not have a high effect size at Jakhoo, the importance of religious affinities and associated beliefs was clear from interviews at both the sites. The majority of the residents who fed rhesus macaques at Jakhoo were Hindus, and they said that their religious principles urged them to do so. The same held true for tourists who engaged in provisioning at Jakhoo. The small percentage of the residents at Mollem who provisioned bonnet macaques also did so because of their religious beliefs. Further, the few tourists at Mollem who stated religious reasons for feeding the macaques were Indian nationals practicing Hinduism. They considered the macaques to be the reincarnation of Lord Hanuman, whose heroism is alluded to in the *Ramayana*. These results concur with those of other studies from South and Southeast Asia, where people also choose to feed primates owing to their religious beliefs (Burton 2002; Wolfe 2002). Likewise, in China, people provision Tibetan macaques (*Macaca thibetana*) because they are influenced by the Buddhist philosophy of providing food to all (Zhao 2005). A study in West Bengal, India, also found that many respondents were guided by religious or cultural practices in provisioning rhesus macaques (Sengupta and Radhakrishna 2018).

The disparity in results at the two sites can be attributed to several factors. First, 24% of resident respondents at Mollem were farmers, whereas none of our respondents at Jakhoo were. It is likely that farmers who suffer from economic losses due to crop-foraging by macaques are more aware of the negative consequences of provisioning and thus would not engage in the practice. Second, the presence of macaques in the premises of a “sacred space” may also have motivated people to feed the macaques, since 56% of residents and 58% of tourists who engaged in provisioning at Jakhoo did so because of

their religious affinities. This influence may also explain why 85% of local residents at Jakhoo provisioned macaques although 50% of them were aware of the detrimental consequences of feeding macaques. Other studies of human–macaque interactions in Southeast Asia have also documented that the presence of macaques within temples adds to their perceived sacredness and influences the way people interact with them (Fuentes *et al.* 2005; Peterson *et al.* 2015). Thus, that the questionnaire survey at Jakhoo was done within the precincts of a temple may have itself been a confounding factor as people's responses may have been influenced by the perceived sacredness of the site.

The differences in our observations at the two sites may also be related to the different nationality profiles of the respondents. At Mollem, 45 of the 53 tourists were from Europe or the United States. Primates do not occur naturally in any of these countries and the foreign nationals were driven mainly to provision by their urge to interact with the macaques. Similar observations have been made with respect to tourists in “monkey parks” in Japan (Knight 2009). In contrast, at Jakhoo, 49 of the 60 tourists were Indian nationals; macaques are not exotic for these tourists and may explain why tourists in Jakhoo were less inclined to provision the macaques. However, residence status was strongly associated with two other predictors—religion and education—so we could not include it as a parameter in our models. Thus we cannot conclude whether residence status is a significant determinant of engaging in provisioning behavior.

The differences we found between the study sites may also relate to the different macaque species present. Mollem is inhabited by bonnet macaques and Jakhoo by rhesus macaques. Bonnet macaques are smaller in size and are known to display less aggressive behavior than rhesus macaques (Clarke and Boinski 1995; Kumar *et al.* 2011; Thierry 2007). People may be warier of rhesus macaques and may feel compelled to feed them. In fact, 12% of resident respondents at Jakhoo said that they were forced to provision rhesus macaques due to the macaques' aggressive behavior. In West Bengal, a similar percentage of respondents said that their practice of provisioning was driven by the aggressive behavior of rhesus macaques (Sengupta and Radhakrishna 2018). Future studies involving the same species of primates across varying sites will shed more light on this question.

Finally, the two sites are distinctly different in nature, which may have also influenced the results. Mollem is a National Park and provisioning is banned by the State Forest Department. Although none of the resident respondents mentioned this as a reason for not provisioning macaques, their general awareness of this law may have prevented them from feeding primates. Jakhoo, in contrast, is not a Protected Area, and hence residents may feel free to provision the macaques.

The difference in the nationality profiles of the respondents at the two sites may also explain why tourists at Jakhoo and residents of Mollem, being citizens of a primate habitat country, were aware of the potential detrimental effects of provisioning macaques such as heightened conflict with humans over shared resources, hyperaggression, and bidirectional disease transmission. The six tourists at Mollem who knew about the possibility of higher crop damage by macaques after being provisioned were also Indian nationals. It is also plausible that the framing of our question on the negative impacts of provisioning influenced the responses, because the question may have showed that the researchers thought provisioning to be detrimental.

Although provisioning macaques was prohibited at Mollem, and there were signboards in English proclaiming this, all tourist respondents still provisioned macaques. Tourists

from non-English-speaking nations may have engaged in provisioning simply because they were unaware of this law. If this is the case, it becomes critical to inform guides to tell clients about the negative impacts of provisioning. However, the tourists who spoke English also provisioned the macaques despite the presence of the signboards. This observation suggests a lack of general understanding about the detrimental effects of provisioning, and even people with a higher level of education often seemed to be unaware of this issue. In many places, programs educating tourists about the impact of humans on animal welfare have led to voluntary changes in tourist behaviors (Ballantyne *et al.* 2009). Similar programs are needed across India. We further recommend that policymakers involve residents in devising programs to educate tourists about the ill effects of provisioning wildlife in Protected Areas. Such residents also need to be employed to keep a strict watch on other residents (such as the jeep drivers at Mollem), who, despite knowing about the ill effects of provisioning, urge tourists to engage in provisioning to reap monetary gains. The Forest Department also needs to be stricter in this regard, recruit staff to keep watch, and impose heavy fines if anyone is found to violate the law.

At religious sites like Jakhoo, researchers also need to inform the State Forest Department about the negative consequences of feeding wildlife. The Department could then recruit people to deter visitors from provisioning wildlife by providing them with relevant information about the issue. At Jakhoo, macaques often steal nonfood items from visitors and then return them only if they are given food (Kaburu *et al.* 2018). Such behavior has also been reported for long-tailed macaques (*Macaca fascicularis*) at the Uluwatu Temple, Indonesia (Brotcorne *et al.* 2017). Instead of trying to convince people about the long-term negative consequences of provisioning, the people keeping watch could warn visitors, citing these examples of the costs that the visitors themselves could incur. They could also urge visitors to hide their food and belongings so that the macaques do not actively seek provisioning by showing aggression or begging gestures. In addition, waste generated within the temple premises needs to be managed properly so that there is no indirect provisioning. Finally, posters are needed in the temple asking visitors to not engage in provisioning.

Most importantly, our results show that there is no singular template for managing human–primate interactions across sites. We suggest that more studies involving diverse sites be conducted to assess region-specific issues that need to be addressed to devise appropriate primate management plans. We also recommend that a mixed-methods approach, involving both quantitative and qualitative data analyses (Riley *et al.* 2017), be used in future studies. While questionnaires can discern specific trends within large populations, qualitative interview data can provide more thorough insights into the attitudes, perceptions, views, and actions of participants (Kendall 2008). Such studies would aid in understanding the multitude of ways in which humans and primates interact with each other in the Anthropocene.

Acknowledgments The authors wish to thank the Goa and Himachal Pradesh State Forest Departments for their support. Rupesh Gawde assisted with field work and Shaurabh Anand helped with maps. A part of this work was presented at the 27th International Primatological Society Congress held in Nairobi, Kenya August 19–25, 2018. The authors wish to thank the organizers of the symposium where this work was presented for their kind invitation. This work was supported by the Science and Engineering Research Board, Department of Science and Technology, Government of India (Grant No. SERB/F/10032/2016-17) awarded to SR. The authors also thank Dr. Joanna M. Setchell and the two anonymous reviewers for their extremely helpful comments that helped improve the manuscript immensely.

Author Contributions AS and SR conceived and designed the study; AS executed the study and analyzed the data; and AS and SR wrote the manuscript.

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