

## Human-Macaque Conflict at the Main Campus of Universiti Kebangsaan Malaysia

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### ABSTRACT

Long-tailed macaques and students at the Universiti Kebangsaan Malaysia (UKM) (National University of Malaysia) main campus have lived together for the past forty years. Overlapping niches between the two sides have caused conflicts between the university residents and long-tailed macaques. In this study, questionnaire surveys were distributed to eight student residential colleges, involving about 776 students. Awareness, perceptions, opinions, and secondary observations of the nuisance behaviour of long-tailed macaques, and the effectiveness of precautionary measures were discussed, based on this survey. The results indicate that three-quarters of the respondents are fearful of the macaques. Less than 10% favoured the macaques' presence on campus, and 15% of the respondents supported the eradication of the population. Half of the respondents suggested that precautionary measures, such as improving waste management and macaque translocation, would be effective methods for managing their nuisance behaviour.

*Keywords:* Long-tailed macaques, *Macaca fascicularis*, nuisance, pest, student perception

### INTRODUCTION

Long-tailed macaques (*Macaca fascicularis*) are known to dwell near the fringes of forest patches and are popularly perceived as pests (Md-Zain *et al.*, 2011). These

macaques disturb local people by exploiting unprotected human facilities such as waste dumps and entering unoccupied houses (Md-Zain *et al.*, 2011) and harassing humans with food cues, such as biting and scratching, as well as stealing food (Sha *et al.*, 2009). These altercations could potentially result in zoonotic disease transmission (Engel & Jones-Engel, 2011), negative attitudes towards animal welfare and conservation (Webber *et al.*, 2007)

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and the damage of macaque-accessible properties (Malaivijitnond *et al.*, 2011).

Previous human-macaque conflict studies have focused on the relationships between habituated macaques and the local community, explaining the variations in human traditions and capabilities in dealing with macaques and the counter-actions taken (Malaivijitnond *et al.*, 2011; Sussman *et al.*, 2011). Rhesus monkeys (*M. mulatta*) of the Aligarh Muslim University Campus (AMU) in India were reportedly involved in nuisance behaviour such as stealing clothes and edible items, and uprooting vegetables and gardens, with more prevalence in female hostels (Imam *et al.*, 2002). The same situation occurred in the Gauhati University Campus in Assam, India, compounded by the problems of overpopulation, improper waste disposal and the easy availability of food, seeming to worsen the scenario, with increased incidents of biting (Devi & Saikia, 2008). Long-tailed macaques at the UKM main campus are semi-habituated (Md-Zain *et al.*, 2010). Md-Zain *et al.* (2011) have recorded previous human-macaque incidences, including the latter foraging at waste dumps, entering buildings and displaying aggression toward humans. The macaques often foraged in garbage cans, invaded rooms, and harassed local people or students, but no physical attacks, such as biting, were observed during the study by Md-Zain *et al.* (2011). Some mitigation measures were put into place, including the installation of wire mesh on the windows, instructions to avoid feeding the macaques, securing waste dumps and bin lids, and the early collection of trash.

Communities that are better prepared and have adequate precautionary measures against macaques are able to be proactive, when compared to the majority, who depend solely on the immediate action of DWNP. In addition to the previously implemented means of monitoring and controlling macaques that are available, local peoples' perceptions and experiences with the animals may provide a better assessment of observed counter-action and precautionary measures. Gathering information on the degree of human disturbance and attitudes of the local community may contribute to the formulation of appropriate measures of deterring macaques. The aim of this study is to assess the awareness, experience, attitudes, and perceptions of UKM students towards the macaques. Their attitudes and perceptions could determine the extent of damage that can be caused by the primates and these factors were measured and assessed in order to suggest decision-making options for the effective management of macaque nuisance behaviour on campus.

## MATERIALS AND METHODS

### *Study Sites*

UKM is located in Bangi, Selangor in Malaysia, and covers approximately 1096 ha. It is located near a lowland secondary dipterocarp forest known as the UKM Permanent Forest Reserve, with a size of 100 ha, surrounded by a golf course, an oil-palm plantation, and many small forest fragments among the clustered student residential colleges (RC): Burhanuddin Helmi, Ibrahim Yaakob, Aminuddin Baki, Rahim Kajai,

Ibu Zain, Keris Mas, Pendeta Za'ba, and Ungku Omar (Fig.1). The structured areas on the campus include the staff housing facilities (residential house of Bukit Puteri, PBP), administration buildings, faculties, clubhouse, health centre, visitor house, mosque, and two stadiums. Fig.1 shows that the UKM main campus has many forest patches, which host several other primate species such as pigtail macaques (*Macaca nemestrina*), banded leaf monkeys (*Presbytis siamensis*), and spectacled dusky leaf monkeys (*Trachypithecus obscurus*), as well as other animals (Md-Zain & Ch'ng, 2011).

#### Survey Questionnaire

The survey questionnaire included questions about student opinions, awareness, attitudes, and experiences with macaques in the residential colleges on the UKM main campus in June of 2010. Seven hundred and sixty-six people from eight RCs participated in the survey. There were no interviews conducted and the questionnaires were distributed randomly. Each respondent had stayed in the RC for at least one semester and only fully answered forms were accepted (766 respondents) and counted for the analysis. After the questionnaires were collected, the data was categorized and analyzed using Minitab® Statistical



Fig.1: Location of study sites indicating the appearance sites of *M. fascicularis*

- 1: Burhanuddin Helmi Residential College (BHRC), 2: Ibrahim Yaakob Residential College (IYRC),
- 3: Aminuddin Baki Residential College (ABRC), 4: Rahim Kajai Residential College (RKRC),
- 5: Ibu Zain Residential College (IZRC), 6: Keris Mas Residential College (KMRC),
- 7: Ungku Omar Residential College (UORC), 8: Pendeta Zaa'ba Residential College (PZRC).

Software (Minitab 14), and  $\chi^2$  analyses were used to test for differences in frequencies between the RCs. The number of the respondents was not consistent between the RCs, which ranged between 86 and 103 respondents each. The differences in the number of respondents were not large, and as such, it was not necessary to standardize the numbers. The proportions and percentages were presented, since all data was nominal.

## RESULTS

The distributed surveys involved 78.4% female respondents and 22.6% males, ranging from 19 to 24 years of age. Ethnically, 77.2% are Malay, 14.8% Chinese, 4.6% Indian, and 3.4% of the respondents answered that they were of other races. Of the participants, 79.4% resided in the dorms, and the rest resided in apartments.

Sixty-one point six percent of the respondents (N = 776) could differentiate between long-tailed macaques and pig-tailed macaques, based on the written description provided in the questionnaire. Ninety-two point one percent of the students agreed that the most sighted raiders were sub-adults and adults. Sixty-one point six percent of the respondents could not differentiate between the sexes of the macaques, although there were significant differences at each study site ( $\chi^2 = 27.479$ ;  $df = 7$ ;  $P = 0.000$ ). The frequency of detection differed among the residents, depending on their ability to detect the presence of macaques ( $\chi^2 = 306.534$ ;  $df = 21$ ;  $P = 0.000$ ). Macaque foraging times, as monitored by the students near the

colleges, were not uniform between the study sites ( $\chi^2 = 97.442$ ;  $df = 21$ ;  $P = 0.000$ ). The estimate of the number of macaques by the residents during foraging also differed between the RCs ( $\chi^2 = 225.05$ ;  $df = 21$ ;  $P = 0.000$ ). Ninety-seven point six percent of the respondents agreed that the macaques were present near the RCs in order to forage. Ninety-four point six percent of the respondents agreed that leftover food encouraged the foraging behaviour.

Harassment by macaques also differed between study sites; for some, more than 53% of the students were disturbed by the macaques ( $\chi^2 = 51.536$ ;  $df = 7$ ;  $P = 0.000$ ). The macaques were seen using a variety of ways to enter student rooms, and these methods were not uniform throughout RCs ( $\chi^2 = 306.534$ ;  $df = 21$ ;  $P = 0.000$ ); only 28% of the respondents noticed the macaques' presence. Fifty-seven point six percent of the respondents had experienced macaques entering their rooms, and 70.9% of them found their room untidy and cluttered, whereas 1.8% discovered faecal matter. Fifty-six percent reported items stolen by the macaques, and 93% of the residents disliked the presence of macaques near their hostels ( $\chi^2 = 14.622$ ;  $df = 7$ ;  $P = 0.041$ ).

Fifteen percent of the respondents had fed macaques before, although the percentage was different according to the site, with the highest percentages noted in the Ibu Zain RC with 30.1% (N = 31) and Burhanuddin Helmi RC with 25.6% (N = 22) ( $\chi^2 = 45.821$ ;  $df = 7$ ;  $P = 0.000$ ). About 91.4% of the respondents thought that the nuisance behaviour could affect both the



health and safety of the residents. About 94% of them agreed that the macaques could obtain a high quality diet in human areas as compared to forest patches, although this answer varied according to the site ( $\chi^2 = 25.875$ ;  $df = 7$ ;  $P = 0.001$ ). Fourteen point four percent of the respondents had complained to the office or RC administrator, while 80.2% ( $N = 622$ ) had not made any complaints. Eighty-three point two percent acknowledged that the responsible parties, both the RC administrator and UKM security, were concerned about the situation ( $\chi^2 = 16.145$ ;  $df = 7$ ;  $P = 0.024$ ). Seventy-three point seven percent of the students agreed that primate translocation could prevent nuisance behaviour ( $\chi^2 = 14.260$ ;  $df = 7$ ;  $P = 0.047$ ); however, only 8.6% of the respondents agreed that culling could be effective in controlling the disturbances.

## DISCUSSION

Based on the respondents' experiences, incidences with macaques most often involved one to ten macaques at a time (41.71%) (Table 1). This was followed by encounters with between ten and twenty macaques at a time (23.98%) (188 respondents). Approximately 34.31% of the respondents came across more than 20 macaques at one time. More than 98% of the students often saw a group of macaques in the evening. From these results, the researcher could infer that students had a higher probability of encountering more than 10 macaques at a time. This suggests that macaques prefer foraging in human areas in small subgroups, with frequent

spreading of groups, since macaque group sizes in the UKM range from 18 to 56 individuals (Md-Zain *et al.*, 2011).

This survey revealed that 28.6% of THE respondents could only confirm the presence of macaques when they came into sight. Twenty-three point five percent of the respondents, who were familiar with the macaques' nuisance behaviour, could predict the presence of macaques based on messy surroundings. Nineteen point two percent of the respondents could detect the presence of a macaque through the macaques' calls, and were able to warn others, which reduced losses and damage. Ninety-three point six percent of the respondents agreed that long-tailed macaques made the area dirty, and 91.4% agreed that their safety and health were at risk as a result of the macaques' nuisance behaviour.

Macaques often take waste bags and drag them away from the dumpsites, leaving them in corridors and drains, resulting in messy and smelly surroundings (Mastura, 2008). Eighty-six point nine percent of the students did not like the macaques because of their habit of tearing apart waste dumps and leaving areas dirty (Table 1). A study by Sha *et al.* (2009), in the Bukit Timah Nature Reserve in Singapore, found that about 13.4% of the total behaviour comprised of searching of bins, cars, and houses. The raiding of caged or protected garbage bins is irregular in Singapore based on observations by Schillaci *et al.* (2007). Closed but unsecured garbage bin lids did not help to deter macaque movements as they have a sharp sense of smell that enables them to detect the scent of food from far away.

About 60% of the students said that the situation had worsened over the current year, compared to the year before. On the other hand, 40% said that the macaques were tolerable for the moment. Respondents from the Rahim Kajai RC only saw the macaques near the bus stop and stated that they rarely visited the dormitory (Table 1). This raiding frequency could be influenced by the availability of food (Table 1). About 97.6% of the respondents believed that the macaques went to the RCs to look for food and this pattern has been recorded since 2003 (Table 1). Macaques leave the forest patches near the RCs, where they sleep, to forage the RC waste dumps. More than 90.4% of the respondents agreed that the possibility of the macaques visiting the residential colleges was the result of unplanned development and the presence of available food from waste bins (Table 1).

Approximately 41.7% of the students witnessed macaques opportunistically entering rooms when windows were left open, and 5.8% of these break-ins were due to damaged windows, while 15.3% of the break-ins occurred when the macaques were able to open the window. Thirty-seven percent of the students did not experience macaque break-ins. In the order of frequency, most students discovered messy rooms (39%), others found no mess, and 14 students found their rooms with macaque droppings and urine after a break-in. The survey responses indicated that students seemed to have gotten used to the after-effects of a macaque break-in.

The behavioural study showed that the frequency of aggression varied between colleges (Md-Zain *et al.*, 2011). More than 71 respondents from each RC felt frightened with the presence of macaques. One form of aggression shown was the chasing of students, which can sometimes involve the biting of those who are slow to run away. There are two primary reasons why the macaques chased the respondents. One was to steal food that the respondents were carrying (Sha *et al.*, 2009), and the other was to scare or force the respondents to leave as they were too near or encroaching the macaque group's perceived territory. Both situations scared the respondents, especially the females, and in one case a respondent who was trying to outrun a chasing macaque fell over. The results also showed that this aggression is the very reason why there is a fear of the species, as 76.2% of the respondents felt scared when the macaques were present, 53.3% of the students had been disturbed or chased by the macaques, and more than 80.15% of the respondents had seen people being chased.

Male macaques, particularly adults, pose a larger threat, as they defend their foraging group. This aggression is not welcomed by students, and any threatening behaviour towards the macaques may be perceived as provocation and lead to the macaques chasing and biting the students in return. About 18 (2.34%) of the respondents had been bitten by macaques, with an average of 2 students per residential college, and a deviation of about 1 or 2 students (Table

1). Recorded direct aggression towards the students was high, and this macaque-human interface may, in turn, promote primate to human disease transmission (Engel & Jones-Engel, 2011). In a random survey in Gauhati University Jalukbari, Guwahati, Kamrup, Assam, India, Devi, and Saika (2008) reported a total of 27 cases of monkey bite incidences and 49 cases of aggressive threats, with physical attacks in the form of scratching, biting and mass chasing of people. Forty-eight bites occurred during 420 provisions of food interactions with tourists in Padangtegal, Bali (Fuentes & Gamerl, 2005). There were 39 (2.1%) human-macaque interactions recorded to have resulted in bites in Gibraltar (Fuentes, 2006). In Singapore, Sha *et al.* (2009) reported that about 19.1% of macaque aggressive interactions included threats, chasing, and lunging. Two-thirds of these interactions were observed when a human was carrying food or indicated other food cues, and one-quarter occurred when a human provoked a macaque (Sha *et al.*, 2009).

The harassment of macaques by students who had been chased or threatened by adult macaques mostly took place in core areas when macaques roamed student passages to faculty buildings (Mastura, 2008; Idris, 2009; Ruslin, 2010). The macaque groups in Keris Mas RC and Aminuddin Baki RC were found to be less of a nuisance compared to other groups because the waste dumps are far from the students' paths and blocks. Places to perch are also not easily available to the macaques, making them less

conspicuous to the students and reducing other potential dangers (Idris, 2009; Ruslin, 2010). In the evening, the macaques occupy forest patches near the bus stops and the pedestrian walks, and the students detected the presence of a troop of macaques from their sounds and visibility. Leaping and a quadruple limb posture displayed by adult alpha males were the most frequent warnings given to respondents (Thierry, 1985) when they failed to notice that they were approaching macaque foraging sites (Ruslin, 2010). Many respondents also stated differences in macaque group sizes as macaques usually separate into subgroups during foraging (Idris, 2009). Ruslin (2010) states that an observer can infer that female adults and juveniles prefer to be vigilant and on the lookout as they forage.

The macaques were rarely given food directly by humans, but they did have direct interactions with the students and did not engage or approach humans for food. Instead they preferred rummaging through garbage bins and felt fear towards humans, staying away even when they noticed students carrying food. The opposite occurs in tourist lodges, camps, temples, and monkey sighting sites, such as those in India, Bali, Gibraltar, and the Bukit Timah Nature Reserve in Singapore (Lee & Priston, 2005). These studies suggest that controlled behaviour and less provocation by humans towards macaques could result in commensal interactions between the students and macaques in the UKM.

Fifteen percent of the students had fed the macaques at least once (Table 1),

TABLE 1  
 Questions used in the survey distributed to the students from eight residential colleges on the UKM main campus.

Questions (N = 776)	SD		$\chi^2$	
	Yes (%)	No (%)	Value	Df
<b>Understanding and knowledge of students about macaques</b>				
Can differentiate <i>M. fascicularis</i> and <i>M. nemestrina</i>	61.6	38.4	7.201	7
Can differentiate male and female macaques	38.4	61.6	27.479	7
Estimated number of macaques when foraging				
1-10	41.5	24	225.050	21
10-20	24.1	10.43		
20-30	12.9	7.67		
> 40	21.5	13.7		
State category of raiders often seen				
Adult	30.5	4.31	8.369	14
Sub-adult	61.6	6.30		
Juvenile	7.9	1.41		
State time for foraging near college				
Morning	7.7	3.63	97.442	21
Afternoon	5.8	4.75		
Evening	58.5	13.63		
All of the above	28	11.65		
State ways to detect the presence of macaques				
Distinct sound	19.2	8.33	51.287	28
Screen or window closed abruptly	13.7	8.55		
Macaques were visible	28.6	11.20		
Messy garbage	23.5	11.07		
No answer	15	28.4		



TABLE 1 (continue)

Questions (N = 776)	SD		$\chi^2$	
	Yes (%)	No (%)	Value	Df
<b>Students attitude concerning macaques</b>				
Favour their presence	6.9	93.1	3.48	5.42
More serious than last year	59.7	40.3	14.02	11.43
Scared when macaques present	76.2	23.8	7.72	7.92
Have feed macaques before	15	85	8.65	9.08
Authorities are concerned about the situation	83.2	16.8	7.25	5.78
Authorities have managed the situation responsibly	91.2	8.77	6.26	2.45
<b>Have experienced nuisance behavior</b>				
Leave the surrounding hostel messy	93.6	6.39	5.62	2.85
Macaques take property	56	44	3.18	28.5
Harassed or chased	53.3	46.7	14.3	15.6
Bitten by macaque	2.3	97.7	1.49	6.39
Seen someone being disturbed by macaque	80.2	19.8	10.19	10.31
Breaking-in, ways macaques seen entering a room				
Through open window	41.7		20.12	306.534
Through damaged window	5.8		3.29	21
Macaque opens window	15.3		11.57	0.000*
No answer	37.1		29.1	
Conditions of room after breaking-in				
No clutter	16.8		9.85	Not valid for $\chi^2$
Cluttered and untidy	39		18.28	
Leave stool	1.8		1.83	

TABLE 1 (continue)

Questions (N = 776)	Yes (%)	No (%)	SD		Value	$\chi^2$	Df	P
			Yes	No				
<b>Student responses in understanding nuisance behaviour</b>								
Macaques were present for foraging	97.6	2.43	5.19	1.48	7.393	7	0.389	
Nuisance behaviours could affect health and safety	91.4	8.6	6.06	1.92	4.689	7	0.698	
Rubbish bins without proper lids encourage foraging	86.9	13.1	4.85	4.57	12.681	7	0.080	
Food left over encourages foraging	94.6	5.42	5.08	2.63	10.526	7	0.161	
High quality of diet in human areas, compared to forest patches	90.4	9.6	6.32	5.44	25.875	7	0.001*	
<b>Suggestions and favourable decisions to overcome problems</b>								
Have made complaint	20	80	12.47	10.55	Not valid for $\chi^2$			
Capture and transfer could prevent nuisance behaviour	73.7	26.3	7.23	6.39	14.260	7	0.047*	
Poison and killing could be effective	8.6	91.4	6.59	9.13	40.085	7	0.000*	
Proper steps to overcome the problems								
Putting up wire nets	23.7		9.95		197.788	42	0.000*	
Reinforcement from DWNP	23.2		9.84					
Effective waste management	22.4		8.97					
Provide inaccessible waste dumps	17.4		7.02					
Cut down or trim trees	2.9		2.264					

which might have increased the occurrence of food-grabbing by the macaques. About 34.57% of the students stated that the macaques had taken things from them. The items stolen were mostly food, followed by beverages (cans, cartons, cups, and in plastic bags), books, notes, etc., as these were the items most often carried by the students and attracted the macaques' attention, possibly being mistaken for food. Observations by Chauhan and Pirta (2010) indicated that rhesus monkeys in urban areas were engaged in snatching and stealing non-edible objects from people as a strategy to obtain food in exchange. Monkeys were often observed taking away valuable things such as spectacles, mobile phones, purses, or shoes from passersby, and dropped them only when severely threatened or, more often, when given something edible in exchange (Chauhan & Pirta, 2010). These observations indicate that the tactics of rhesus monkeys are associated with the exchange of commodities (Drapier *et al.*, 2005; Chauhan & Pirta, 2010). In UKM, 86.47% of the stealing by the macaques involved food and beverages, while the rest involved the taking of books and notes. The surveys revealed differences between the residential colleges, with Aminuddin Baki RC and Pendeta Za'ba RC indicating that more than 70% of the students had not had items taken from them. In Aminuddin Baki RC and Ungku Omar RC, however, students had lost clothes from clothes lines and toiletries to the macaques.

The effectiveness of the RC administrators and UKM security

in implementing control measures was questioned to clarify the students' perceptions of the party responsible for macaque nuisance controls. About 15.6% of the respondents complained to the residential college office and campus wardens. Another 4% complained to the student council and of UKM and DWNP (Table 1). Suggestions by the respondents to reduce the occurrences of nuisance behaviour varied between preventive, control, and intrusive measures such as installing wire nets on the windows. This kind of prevention is similar to the preventative measures taken by the residents in Vrindavan, India, who covered windows and open places with screens, barbed wire or iron grills to prevent rhesus monkeys from entering (Southwick *et al.*, 2005). This measure was preferred by the students (25.7%) as it is the most effective for all of the residential colleges. Twenty-eight percent of the students agreed that securing the bins could help to dissuade the macaques from rummaging, since the absence of food patches would discourage their presence in RCs. Meanwhile, culling by DWNP or scare tactics were suggested as reliable methods by 23% of the respondents in order to reduce disturbances. More than 76.3% of the respondents also believed that capture and translocation methods should help to control nuisance behaviours although the rest did not think that this was necessary (Table 1). About 8.6% agreed with the use of poison or culling to overcome the problem. About 3% of the respondents also suggested cutting down trees near RCs, since the macaques tend to take cover in the nearest tree while

foraging; however, the RC administrator has no plans to execute this suggestion. The students are partially affected by the nuisance behaviours but only 8.6% of them agreed that poison or culling could be effective in controlling the situation. The implementation of precautionary measures and effective waste management is crucial for the efficient long-term management of this pest species in UKM.

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