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Macaque–Human Interactions and the Societal Perceptions of Macaques in Singapore

JOHN CHIH MUN SHA^{1,*}, MICHAEL D. GUMERT², BENJAMIN P. Y-H. LEE¹, LISA JONES-ENGEL³, SHARON CHAN¹, and AGUSTÍN FUENTES⁴

¹Central Nature Reserve, National Parks Board, Singapore, Singapore

²Division of Psychology, School of Humanities and Social Sciences, Nanyang Technological University, Singapore, Singapore

³Division of International Programs, University of Washington-NPRC, Seattle, Washington

⁴Department of Anthropology, University of Notre Dame, Notre Dame, Indiana

Abstract

Humans and long-tailed macaques (*Macaca fascicularis*) interface in several locations in Singapore. We investigated six of these interface zones to assess the level of conflict between the two species. We observed macaque-to-human interactions and distributed questionnaires to residents and visitors of nature reserves. We observed an average of two macaque-to-human interactions per hour at the sites, which included affiliative or submissive behaviors (46.9%), aggression (19.1%), taking food and other items (18.5%) searching bins, cars, and houses (13.4%), and nonaggressive contact (2.1%). Two-thirds of interactions occurred when a human was carrying food or food cues, and one-quarter occurred when a human provoked macaques. Only 8% of interactions occurred without a clear human-triggered context. Our interview showed one-third of respondents experienced nuisance problems from macaques. They had items taken from them (50.5%) and received threats (31.9%). Residents reported more nuisance problems than visitors, and their perceptions toward macaques differed. Residents were more aware of the consequences of food provisioning and that there were regulations against feeding. Residents fed macaques less and held more negative sentiments toward macaques. Nearly half of the interviewed people held neutral attitudes toward macaques and only 26.2% of respondents thought conflict with macaques warranted urgent action. Nearly two-thirds of the respondents supported education programs to ameliorate human–macaque conflict, and less than 15% supported removing or eradicating macaques. 87.6% felt that it is importance to conserve and protect macaques. Our results show that human–macaque conflict exists in Singapore, but that it may not be severe. Human behavior is largely responsible for macaque-to-human interactions, and thus could be lessened with management of human behavior in interface zones (i.e. restrict food carrying and provocation). Moreover, our interviews shows people living in Singapore value macaques, do not wish them entirely removed, prefer education-based solutions, and consider conservation and protection of them important.

*Correspondence to: John Chih Mun Sha, Conservation and Research Department, Wildlife Reserves Singapore, 80 Mandai Lake Road, Singapore 729826, Singapore. shacm@singnet.com.sg.

Keywords

Macaca fascicularis; Singapore; commensalism; human–macaque conflict; human dimensions of wildlife management

INTRODUCTION

Long-tailed macaques (*Macaca fascicularis*) are one of the world's most numerous, widespread and ecologically diverse primates [Fooden, 1995; Wheatley, 1999]. They are known to inhabit a wide range of tropical habitats and are highly opportunistic omnivores [Aldrich-Blake, 1980; Fooden 1995, Poirier & Smith, 1974]. In Singapore, there are approximately 1,464 long-tailed macaques and 70% of the population occurs in the Bukit Timah Nature Reserves (BTNR) and Central Catchment Nature Reserves (CCNR) [Sha, 2008; Sha et al., 2009]. The population of macaques inhabits areas near roads and human habitation, and at least 50% of the population obtains some of their diet from anthropogenic food sources [Sha et al., 2009]. The close interface of macaques with humans has led to conflict, with the first problematic situation being recorded in Singapore at the Botanic Gardens during the 1960s [Harrisson, 1966; Medway, 1969]. Eventually, this conflict led to a decision to eradicate those macaques in the 1970s [Tan et al., 2007].

At the Botanic Gardens, reports of human–macaque conflict have continued in other parts of Singapore [Corlett, 1996; Lucas, 1995]. In recent years, media reports of macaque nuisance problems have increased [Murdoch, 2007; Sua, 2007]. Moreover, public complaint records kept by Singapore's Agri-food and Veterinary Authority (AVA) and the National Parks Board (NParks) have indicated a rise in conflict over the last decade. Public complaints received by the AVA about conflict with macaques more than doubled between 2001 and 2007 ($N = 2115$, mean 302/yr) from the annual average of complaints recorded between 1996 and 2000 ($N = 590$, mean 118/yr) (Unpublished data). Management authorities have attempted to ameliorate this rise in public complaints by trapping and removing macaques from areas where complaints occur [Mulchand & Tan, 2008]. Consequently, this situation truly represents a conflict between humans and macaques, as both species are negatively impacted by competition over space and resources.

The increase in human–macaque conflict may have originated because of the severe ecological alterations in Singapore over the last two centuries. Since 1819, Singapore has lost more than 95% of its original forest cover [Corlett, 1992; Turner et al., 1994], and presently the BTNR and CCNR are the only major forest reserves left in Singapore. These reserves are now forest islands, encircled by roads and expressways, with no buffer zones between the forest patches and human settlement. For example, at Bukit Timah, there are seven condominiums and one private estate located within 200 m of the reserve, comprising around 1500 dwellings with approximately 6000 residents [Lee (personal observation); Ooi et al., 2007]. Some of these apartment complexes are less than five meters from the forest reserve border. This lack of buffer between urban Singapore and its forest reserves has resulted in an increased proximity between human and macaque populations, which creates a human–macaque interface zone where conflict between the two species can occur.

In interface zones, humans and macaques have direct interactions because they utilize some of the same spaces (e.g. roads and sidewalks). A recent study by Fuentes et al. [2008] indicated that human–macaque interactions in Singapore occur most frequently when humans were carrying or offering food items, and this is similar to findings in Bali, Indonesia [Fuentes, 2006a,b]. In Singapore, it is an offence punishable with fining to feed monkeys within the boundaries of the nature reserves under the National Parks Board Act (Chapter 198A) since 1997 [NParks, 1997]. Despite this, fining macaque feeders has not eradicated the problem. For example, feeding outside of park and reserve boundaries is beyond the jurisdiction of the feeding fine. Moreover, in 2007, 157 feeders were fined inside Singapore's parks, which were the most number of fines given in any single year since the enactment of the law [Mulchand, 2008]. This inability to stop macaque feeding inside the parks entirely through punishment indicates that there may be underlying social factors contributing to the behavior of feeding monkeys that are difficult to reverse. These factors should be better understood in order to target management efforts appropriately.

In Singapore, the two major groups interfacing with macaques are park visitors and residents living near reserve borders. These two groups of people interact differently with macaques and are likely to have different perceptions about them [e.g. Elmore et al., 2007; Fellowes, 1992; King & Lee, 1987; Lucas, 1995; Strum, 1984]. Residents are likely to be more disturbed by macaques, and visitors may be more amenable to having macaques living around the parks. This difference is because the costs associated with the human–macaque interface are greater for residents who must frequently interact with macaques during their daily lives. In contrast, visitors to the parks are only interacting with macaques for short periods and during their leisure time. Residents also are more likely to suffer loss or damage of property than visitors. By assessing the attitudes of people toward macaques we can study the differences in perceptions of visitors and residents. In addition, we can also obtain an estimate of the value of macaques to Singaporeans. Such information could aid our understanding of the human–macaque interface and be useful to management decisions aimed at ameliorating conflict.

In this study, we assessed human–macaque conflict in Singapore by investigating the relationship between humans and macaques. First, we studied macaque-to-human interactions and their context at six locations reported to have high macaque densities and high levels of human–macaque conflict in Singapore. Second, we provided questionnaires to residents and visitors of the nature reserves in Singapore. We inquired about feeding, as well as knowledge, attitudes, and opinions about management strategies for macaques. We tested for differences between residents and visitors in their perceptions toward macaques. Lastly, we examined the complaint records and media reports on macaques in Singapore and related their trends to the actual level of human–macaque interaction and the perceptions that people have about Singapore's macaques.

METHODS

Study Area

Singapore (103°50'E, 1°20'N) is located off the southern tip of Peninsular Malaysia and covers an area of approximately 685 km². Less than 5% of the island is forested and the

remaining forest consists of small fragments among a highly urbanized environment [Cortlett, 1992; Turner et al., 1994]. One of the largest remaining forest fragments is in the central portion of the island in the 2,000 ha Central Catchment Nature Reserve and 164 ha Bukit Timah Nature Reserve. The Central Catchment Nature Reserve consists of forested areas surrounding several reservoirs that are protected as Singapore's major watersheds.

We identified six study areas (Fig. 1a) that had high macaque densities [Sha et al., 2009] and incidents of macaque complaints from AVA/NParks [2005] and Table III (See Fig. 1b). These areas were at Bukit Timah Nature Reserve and parks near or within the Central Catchment Nature Reserve. The first site, Bukit Timah (163 ha), is the most visited nature reserve in Singapore, and is used for trekking, nature walks, photography, cycling, bird watching, and exercise. Four other sites were MacRitchie Reservoir Park (12 ha), Upper Peirce Reservoir Park (6 ha), Lower Peirce Reservoir Park (6 ha), and Upper Seletar Reservoir Park (15ha), which are all recreation parks at the Central Catchment Nature Reserve, and are visited by picnickers, joggers, and nature enthusiasts. Upper Seletar is adjacent to a 9-hole golf course that is open to the public, and sometimes encroached by macaques.

Macaques often frequent the area surrounding Old Upper Thomson Road, a narrow double-lane road that links Upper Peirce and Lower Peirce. Three of these parks, MacRitchie, Lower Peirce, and Bukit Timah, have numerous condominiums and private housing estates right at the borders of the reserve and park area boundaries. For example, at Bukit Timah, nothing separates houses from the designated reserve boundary and trees overhang some of the condominiums and border within 1 or 2 m of the forest edge. At MacRitchie, some houses are built along the park border with only fenced yards separating the privately owned residential areas from the park. Also, along Lower Peirce, only Old Upper Thomson Road separates private houses and condominiums from the park areas, and thus macaques easily enter the residential areas. The sixth site was along Rifle Range Road, which is the main road linking Bukit Timah and the Central Catchment Nature Reserve, as well as an area of frequent complaint about human-macaque conflict by pedestrians and joggers along the road.

Observation of Macaque-to-Human Interactions

In each of these six areas we observed how macaques interacted with humans between June 2nd and August 27th 2007. Observations were conducted for 2 hr at a time, and 24 hr of data were collected at each of the six sites for a total of 144 hr. Observations were conducted along routes that were selected because of the presence of human settlement, high human activity, and macaques. The first author and an assistant searched these routes for macaques and once groups were encountered, observations began. Observers followed the macaques and recorded interactions between macaques and humans *ad libitum* [Altmann, 1974]. When the macaque group was lost during an observation period, the observer scanned the routes until macaques were sighted again and resumed observation.

Interactions were classified into several categories of macaque-to-human behavior. We recorded aggressive interactions, which were (1) threats, (2) lunging or chasing, and (3) scratching or biting. We also scored the grabbing and taking of food or possessions by

individual macaques and food mob-bing where numerous macaques tried to grab food from a person. Other social interactions we scored included (1) affiliation & submission and (2) non-aggressive physical contact. Lastly, we recorded interactions with any human structures in the environment, such as trash bins, cars, and houses. In addition to these behaviors, we recorded the context of each interaction observed. Contexts were classified into three categories: feeding, provoked, and retaliation. Feeding was when feeding or feeding cues (e.g. human carrying a plastic bag or food package) occurred during the interaction. A provoked context was when a human initiated action toward a macaque (e.g. chasing, pointing at close range, approaching closely, etc.). Lastly, interactions were classified as a retaliation context if humans reacted to macaques by chasing them away or physically advancing on the macaques to intervene the macaque's activity (e.g. stop a macaque from grabbing food from a trash can, entering a home, sitting on a car, etc.).

Questionnaire Survey

The survey questionnaire (in English) included both objective and subjective questions about the opinions, knowledge, and attitudes toward macaques by residents and visitors to the parks. 519 people participated in the survey. 393 surveys were administered to park visitors from all areas except Rifle Range Road. 126 surveys were administered to residents living on the borders of Bukit Timah, Lower Peirce, and MacRitchie. Visitors were surveyed by volunteers and staff of National Parks Board (NParks), and were approached and asked to answer a series of questions. Interviewers were stationed along the same routes used for behavior data collection and they approached visitors met along the route. Residents were surveyed by interviewers that went from house-to-house in residences along park borders. Each questionnaire survey was conducted verbally and answers were recorded by the interviewer in the presence of the participant.

Complaints and Media Portrayals

We obtained and compiled the records of unsolicited complaints received by email from the NParks ($N = 29$) between January and October 2007. Each complaint was classified according to its context. Contexts were, (1) "stealing" food and/or belongings, (2) entering and/or damaging property, (3) attacks, (4) general nuisance, and (5) macaque sightings. In addition to this, we also compiled media headlines from Singaporean newspaper articles between 2004 and 2008 ($N = 46$). Each headline was classified according to whether it conveyed positive, negative, or neutral connotations toward macaques. Negative connotations included words such as "rob," "steal," "thieving," "aggressive," "nasty," "harassed," "havoc," "nuisance," "threat," "torment," "mayhem" or conveying message of macaque as "obstructing traffic," "stopping passersby," or "causing a vehicle crash." Positive or neutral connotations included depicting macaques as "not a threat to park visitors," "man and not animals as culprits," and "feeding that harms macaques," and general discussions about macaques.

Data Analysis

We calculated the proportion that each behavioral category represented of the total ad libitum data set as well as the rate of observed interaction per hour of observation. We used

a χ^2 test to test whether there was variation in the proportion of interaction types among the six study sites to determine if there might be any differences between study sites in the type of macaque-to-human behavior observed. In addition, we used χ^2 tests to test for differences in frequency between the different types of macaque-to-human interactions. This allowed us to determine if certain types of macaque-to-human interactions were more common than others. Lastly, we used independent t -tests to test whether more macaque-to-human interaction occurred in human-triggered contexts than in context without any clear human instigation.

All of the questionnaire survey data were checked for completeness and unclear answers were removed from the analysis. No forms were completely discarded, as a survey needed only to contain at least one complete answer to a question to be useable. The survey answers were categorized and the percentage of each type of answer was calculated. An arcsine transformation was applied to normalize the percentage data, and we used independent-sample t -tests to determine whether there were any significant differences between the responses of residents and visitors for all of the survey questions. χ^2 tests were used to test for significant differences between (1) the types of nuisance problems experienced by respondents, (2) attitudes toward macaques, (3) attitudes toward macaques among those not ever harassed, (4) attitudes toward macaques among those who have been harassed (5) context of complaints received in 2007, and (6) rationale for conserving macaques.

We also compared the following subsets from the questionnaire data using independent t -tests. (1) Among those who knew about the fine for feeding macaques, we compared how many fed macaques and how many did not. (2) Among those who expressed inclinations to feed macaques, we compared how many thought macaques had enough natural food resources and how many did not think they had enough. (3) Among those who thought that urgent action is needed, we compared how many supported manipulation of the macaque population and how many supported education on co-existence. (4) We assessed if there were differences in the respondents' attitude toward macaques (i.e. positive, negative, or neutral), depending on whether someone had received harassment or not. (5) Among those who indicated an urgent need for action, we compared how many had received harassment and how many had not. (6) Among those who indicated support for direct manipulation of the macaque population, we compared how many had received harassment and how many had not. We determined whether the proportion of positive headlines on macaques in Singapore's media was significantly less than the proportion of neutral and negative headlines combined by using independent t -tests. All analyses were conducted using the Statistical Package for the Social Sciences version 13.0 [SPSS Inc., Chicago, IL). Statistical significance for all tests was set at $P < 0.05$.

All research reported in this manuscript adhered to the American Society of Primatologists Principles for the Ethical Treatment of Non Human Primates. Research protocols reported in this manuscript did not involve any laboratory manipulation of animals or animal parts and did not violate any wildlife protection acts in the county of research—Singapore. All research reported in this manuscript adhered to the legal requirements of Singapore and has been approved by the National Parks Board, Singapore.

RESULTS

Occurrence and Context of Macaque-to-Human Interaction

A total of 292 macaque-to-human interactions, where macaques directed behavior toward humans or human-made substrates, were observed during the 144 hr of observation (Table I). The rate of macaque-to-human interaction was $2.03 \pm \text{SD } 0.45$ interactions per hour. The frequency of interaction differed among the six observation sites ($\chi^2 = 104.4$; $\text{df} = 20$; $P = 0.001$). Affiliative/submissive gestures were highest at Upper Peirce (65.6%), Lower Peirce (59.5%), and Rifle Range Road (57.5%). Grabbing or taking human possessions were highest at Upper Peirce (28.9%), MacRitchie (23.5%), and Bukit Timah (22.5%). Lunging and chasing behavior were highest at Upper Peirce (13.4%) and MacRitchie (16.5%). House, bin, and car raiding behavior were most common at Bukit Timah (32.5%) and Rifle Range Road (17.3%). Mobbing behavior was only observed twice, once at Rifle Range Road, and once at MacRitchie. Physical contact without aggression occurred at three of the six sites—Upper Peirce, MacRitchie, and Bukit Timah.

The distribution of types of macaque-to-human interactions was not uniform ($\chi^2 = 382.1$; $\text{df} = 7$; $P < 0.001$). The most common macaque-to-human interaction was affiliative/submissive (46.7%), followed by grabbing or taking human possessions (17.8%), threats (9.9%), lunging or chasing (9.2%), physical contact without aggression (2.1%), and mobbing (0.7%). No bites or scratches (0%) were observed during this study. Interaction with the human environment contributed to 13.4% of observed interactions and involved mainly searching of cars and trash bins.

Macaque-to-human interactions occurred mainly in the context of feeding, as nearly two-thirds of all interactions were related to food or food cues. 65.5% of interactions observed in this study occurred in the context of direct feeding or reaction to feeding cues. 6.3% of the interactions observed were in the context of human provocation, and 20.3% of interactions were in the context of human retaliation. Only 7.9% were in a context with no clear influence by the human target, and this was significantly less than the three human-triggered contexts combined (independent t -test: $t = -8.0$; $\text{df} = 10$; $P < 0.001$). Moreover, all interactions in this unprovoked context were affiliative/submissive. Overall, most interactions (85.8%) were the result of direct conflict over food and/or space.

Human Reports on Interactions

We asked whether people ever experienced a nuisance problem from macaques in the form of a yes/no question. We found that 35.5% ($N = 182$) of interviewed respondents reported having experienced some form of nuisance. We further asked what kind of nuisance problems they experienced. We found that 50.5% reported having had items taken by macaques. In addition, 31.9% reported being threatened, chased, or followed, 10.5% were bitten or scratched, and 7.1% received property damage from macaques. The types of nuisance problems experienced were not uniform across sites, and the taking of food or other items was the most common type of nuisance (χ^2 test: $\chi^2 = 89.6$; $\text{df} = 2$; $P < 0.001$).

We also found differences between residents and visitors. It was reported that 68.3% of residents and 24.4% of visitors experienced nuisance problems, and this difference was

significant (independent *t*-test: $t = 5.942$; $df = 180$; $P < 0.001$). The percent of residents (29.1%) and visitors (34.4%) who experienced threats (independent *t*-test: $t = 0.820$; $df = 180$; $P = 0.4132$) and/or having had items taken from them (residents: 53.5%; visitor: 47.9%, independent *t*-test: $t = 0.877$; $df = 180$; $P = 0.3816$) was not found to be significantly different. Visitors (17.7%) did report significantly more experiences of being bitten or scratched by macaques than residents (2.3%) (independent *t*-test: $t = 3.407$; $df = 180$; $P = 0.0008$). Only residents experienced property damage, which amounted to 15.1% of the nuisance problems reported.

We asked people what they thought were the causes of macaque-to-human interaction, and provided four possible answers. We found that the majority of people perceived the cause to be the result of attraction to food (58.6%). The three other causes were the macaques being provoked by humans (18.5%), being playful (17.8%), and being aggressive (5.1%). The percent of residents (71.3%) who thought that nuisance problems were caused by macaques attracted to food was significantly higher than visitors (53.8%) (independent *t*-test: $t = 0.5178$; $df = 409$; $p < 0.001$). In addition, more visitors (20.9%) than residents (9.6%) thought that problems were owing to macaques being playful (independent *t*-test: $t = 2.721$; $df = 409$; $P = 0.0068$). The percent of visitors (4.7%) and residents (6.1%) that thought that macaques were aggressive (independent *t*-test: $t = 0.580$; $df = 409$; $P = 0.5625$) or provoked by humans (independent *t*-test: $t = 1.806$; $df = 409$; $P = 0.0717$) was not found to be significantly different in this study.

Human Reports of Macaque Feeding

In our survey, we queried people about their behavior and knowledge on the feeding of macaques, and its influence on human-macaque conflict. We found that 14.2% of all respondents reported having fed monkeys in the past, and that 16.8% reported that they would be interested in feeding the macaques in the future. 74.6% of all respondents knew that they were liable to be fined if they were caught feeding monkeys, and thus there was high awareness of the law. We also found clear differences between visitors and residents in attitudes and knowledge about feeding. We found that significantly more visitors (16.4%) than residents (7.3%) reported to have fed the macaques at some time (independent *t*-test: $t = 2.532$; $df = 505$; $P = 0.0116$). We also found that significantly more visitors (20.1%) than residents (6.6%) reported being more interested in feeding macaques in the future. Lastly, we found that residents (80.3%) were significantly more aware of the feeding fine than visitors (72.8%) (independent *t*-test: $t = 3.093$; $df = 371$; $P = 0.0021$).

We also tested if people with knowledge about the fines reported different behavior than those not knowledgeable about the fines, in order to assess the impact of fining on feeding behavior. Among those who knew about the fine for feeding macaques, the percent that reported to have fed monkeys in the past or an interest to feed monkeys in future ($N = 56$, 15.0%) was significantly lower than those who indicated that they did not know about the fines (85.0%) (independent *t*-test: $t = 14.515$; $df = 498$; $P < 0.0001$). We did find that 33.3% of those who were inclined to feed macaques claimed they did not know about the fine. 79.2% of all respondents ($N = 392$) thought that the feeding ban was effective at reducing monkey feeding, but $N = 44$ (11.2%) questioned the effectiveness of enforcing it. These

skeptical respondents expressed the need for heavier fines, more enforcement, or stronger education efforts. 57.3% of respondents felt that macaques had enough food in the forests and did not require additional human provisioning, and only 25.9% of such respondents reported having fed or having an interest to feed the macaques. In contrast, 65.0% of those inclined to feed monkeys thought the macaques did not have enough natural food sources, and 47.1% of these respondents reported to have fed or to have an interest to feed macaques. These two groups differed significantly in the amount of feeding or interest in feeding reported (independent *t*-test: $t = 4.788$; $df = 493$; $P < 0.0001$).

Attitudes About Macaques and Their Management

In our questionnaire, we investigated the attitudes that people have toward Singapore's macaques. We provided five options for them to answer, (1) strong liking for macaques; (2) mild liking for macaques, (3) strong dislike for macaques; (4) mild dislike for macaques, and (5) neutral about macaques. Both strong and mild like were grouped as a positive attitude and both strong and mild dislike as a negative attitude. We found 47.4% of interviewees held neutral attitudes, 32.9% held positive attitudes, and 19.7% held negative attitudes and that attitudes were not uniformly distributed (χ^2 test: $\chi^2 = 58.0$; $df = 2$; $P = 0.0001$). We also found differences between visitors and residents in attitude. Visitors viewed macaques more positively than residents, because the percent of visitors that reported a positive attitude for macaques (36.8%) was significantly higher than residents (21.0%) (independent *t*-test: $t = 3.386$; $df = 505$; $P = 0.0008$). Moreover, the percent of visitors that reported a negative attitude (15.7%) was significantly lower than residents (32.2%) (independent *t*-test: $t = 4.012$; $df = 505$; $P < 0.001$). We could find no significant difference in neutral attitudes toward macaques between visitors and residents (independent *t*-test: $t = 0.136$; $df = 505$; $P = 0.8921$).

We questioned people on whether they were aware of human–macaque conflict in Singapore and whether they thought any urgent management was needed. We found that 66.2% of all respondents reported being aware of conflict between humans and macaques. Residents (84.8%) were significantly more aware than visitors (59.9%) (independent *t*-test: $t = 5.057$; $df = 394$; $P < 0.001$). 26.2% of all respondents reported thinking that an urgent management program was needed.

We further asked people what measures they thought should be taken to manage macaques. Interviewees were provided with five choices, (1) complete eradication of macaques from Singapore, (2) population reduction, (3) removal of nuisance macaques, (4) keeping nuisance macaques from urban areas, or (5) education on co-existence with macaques. We found that the majority (63.6%) of people interviewed thought that education on coexistence with the macaques would be the most important measure if any were to be taken. The next popular option (21.1%) was keeping macaques or nuisance monkeys from park borders and urban areas. Only 10.9% felt that it was important to reduce the population, 2.2% were for removal of nuisance macaques, and 2.2% thought that macaques should be completely eradicated from Singapore. In addition, of those reporting a need for urgent action, 47.2% supported direct manipulation of the macaque population (i.e. reduce or eradicate) and

52.8% supported education on coexistence. We could not find any significant difference between these two perspectives (independent *t*-test: $t = 1.209$; $df = 501$; $P = 0.2274$).

We investigated the differences between residents and visitors in their opinions on resolving human-macaque conflict. We found that significantly more residents (21.5%) than visitors (7.6%) supported reduction of macaque population (independent *t*-test: $t = 4.309$; $df = 501$; $P < 0.001$) and removal of nuisance macaques (residents 5.8%, visitors 1.0%) (independent *t*-test: $t = 3.170$; $df = 501$; $P = 0.0016$) and significantly more visitors (67.3%) than residents (52.1%) indicated education on co-existence with macaques (independent *t*-test: $t = 3.953$; $df = 501$; $P = 0.0001$). Residents and visitors who indicated eradication of macaques (residents 0.8%, visitors 2.6%) and keeping nuisance macaques out of urban areas (residents 19.8%, visitors 21.5%) did not differ significantly (independent *t*-test: $t = 2.2$; $df = 501$; $P = 0.2366$, $t = 21.1$; $df = 501$; $P = 0.5235$). We also found that the percent of residents who stated a need for more urgent action and supported more immediate management methods (64.3%) were higher than visitors (33.8%) (independent *t*-test: $t = 3.418$; $df = 125$; $P = 0.0009$). Overall, 87.6% of total respondents believed that macaques should be conserved and provided more protection, and this was not found to be significantly different between visitors and residents (independent *t*-test: $t = 0.276$; $df = 344$; $P = 0.7823$).

Out of 112 respondents who provided subjective answers to the rationale for conserving macaques, 38.4% reported that macaques play an important role in balancing the forest ecosystem, 26.9% reported that macaques have an intrinsic biodiversity value, 20.9% reported that macaques should be protected for welfare reasons, 8.8% reported their esthetic and entertainment value, 2.7% reported religious reasons, and 2.3% reported other reasons. The rationale for conserving macaques was not uniformly distributed (χ^2 test: $\chi^2 = 63.5$; $df = 5$; $P < 0.0001$). Questions and responses to the interviews are compiled and summarized in Table II.

Experience and Attitude Toward Macaques

We investigated if people that had negative experiences with macaques were more likely to show negative attitudes toward them, and whether they were more supportive of urgent action being taken. We found that responses among people that had been harassed were not uniformly distributed. 36.1% indicated positive attitudes toward macaques, 23.2% indicated negative attitudes, and 40.7% indicated neutral attitudes (χ^2 test: $\chi^2 = 9.541$; $df = 2$; $P = 0.0085$). Responses among those not ever harassed were also not uniformly distributed. 30.3% indicated positive attitudes toward macaques, 17.5% indicated negative attitudes, and 52.2% indicated neutral attitudes (χ^2 : $\chi^2 = 60.436$; $df = 2$; $P = 0.0001$). People who had experienced harassment were not found to be significantly more likely to indicate a difference in their overall attitude toward macaques, whether positive (independent *t*-test: $t = 0.820$; $df = 460$; $P = 0.4128$) or negative (independent *t*-test: $t = 1.275$; $df = 460$; $P = 0.2029$) but neutral attitudes toward macaques were significantly lower for those who had received harassment (independent *t*-test: $t = 2.006$; $df = 460$; $P = 0.0455$). Therefore, past experiences with macaques did not seem to be strongly related to a person's general attitude toward them.

In contrast, we did find that past experience affected people's opinions on management strategies. First, those who received harassment ($N = 182$) were significantly more likely to indicate an urgent need for action than those who had not received harassment ($N = 330$) (33.5% compared with 20%) (independent t -test: $t = 3.515$; $df = 510$; $P = 0.0005$). Secondly, people that had received harassment were not found to be more likely to support direct manipulation of the macaque population (49.9%) than alternative strategies (51.1%) (t -test: $t = 0.297$; $df = 181$; $P = 0.7669$). However, when we compared residents and visitors, we found that residents that had received harassment supported direct manipulation of the macaque population (69.8%) significantly more than visitors that had (30.2%) (independent t -test: $t = 5.336$; $df = 180$; $P < 0.001$).

Complaints and Media Headlines

We compiled complaint records and media headlines to assess the contexts that human-macaque conflict occurred in and how the media has portrayed the conflict. To investigate complaints, we examined feedback emails to NParks ($N = 29$) that were received between January and October 2007 (Table III). From this sample, we found five contexts in which complaints occurred. We found that 37.9% of complaints were related to having food and belongings taken, 27.6% were about macaques that had entered or damaged property, 10.3% were perceived as attacks, 6.9% were general nuisance complaints, and 17.3% were simply reports of monkey sightings that had concerned the informant. These complaint contexts were not uniformly distributed (χ^2 test: $\chi^2 = 9.4$; $df = 3$; $P = 0.002$). We also assessed 47 media headlines from Singaporean newspapers (Table IV) between 2004 and 2008. We found that 20 (42.6%) articles contained words conveying negative connotations to macaques, that 6 (12.7%) contained positive connotations, and 21 (44.7%) contained neutral connotations. Positive headlines on macaques in Singapore's media were significantly less than neutral and negative headlines (t -test: $t = 5.224$; $df = 46$; $P < .0001$).

DISCUSSION

Macaque-to-Human Interactions in Singapore

Our observations of macaque-to-human interactions in high interface areas of Singapore indicated which types of interactions were most common and the contexts in which these interactions occurred. Nearly half of all macaque-to-human interactions observed were affiliative or submissive, about a fifth involved taking or grabbing of food or other items possessed by people, and approximately a ninth involved macaques accessing houses, refuse bins and cars. Nearly two-third of all interactions occurred when people were carrying food or food cues (i.e. bags or packages), and around one-quarter of all interactions occurred directly from human provocation or retaliation. Only 8% of all interaction had no clear provocation from humans, indicating that potentially some simple alterations in human behavior around macaques (i.e. not carrying food or provoking macaques) could possibly reduce up to 90% of all behavior that long-tailed macaques direct toward humans in Singapore.

Occurrence and frequency of interaction types differed among the six different study areas. A variety of factors may influence how macaques and humans interact. These could include

features of the location, as well as the history of interaction between people and macaques at a site. Interaction may vary in response to the degree of overlap in physical space, macaque hunger, thirst, and/or changes in season (e.g. fruit availability). Additionally, macaques may be more motivated to interact with people based on their prior experiences surrounding feeding, harassment, and/or other contact with humans [Alexander & Roth, 1971; Anderson et al., 1977; Eaton et al., 1981; Erwin, 1977; Erwin & Erwin, 1976; Fellowes, 1992; Southwick, 1967; Southwick, 1969]. Overall, our results suggest that the majority of macaque-to-human interactions seemed related to locating and obtaining food. This result has also been found in numerous other countries where high levels of macaque interface occur [Hong Kong: Fellowes, 1992; Bali: Fuentes & Gamerl, 2005; Fuentes et al., 2005; Malaysia: Norma-Rashid & Azarae, 1992; Gibraltar: O'Leary & Fa, 1993; Fuentes, 2006a; India: Pirta et al., 1997; China: Zhao, 1994; Zhao, 1996].

Our investigations using interview surveys, complaints records, and media headlines indicated the common types of nuisance problems received by people, as well as attitudes and perceptions held about macaques. We found that taking of food items or belongings, receiving aggression by macaques, and experiencing property damage to fruit trees and ornamental gardens were the most common types of complaints from people interfacing with macaques. Only about a third of respondents had reported being harassed by macaques, and residents reported more nuisance problems than visitors. The percent of residents and visitors who experienced common nuisance problems like threats and taking of items were not found to differ, but visitors reported more bites and scratches, and only residents experienced property damage. This demonstrates that each of these groups face different challenges in areas of human-macaque interface.

No bites or scratches were observed to occur in this study or by another recent study in Singapore [Fuentes et al., 2008], although 10% of interviewed respondents indicated being bitten or scratched. In India, it is estimated that 100 people were being injured by monkeys every day, of which many were bites [Malik, 2001]. In Gibraltar, UK, 248 bite cases were reported in a 9-year period [Fa, 1992]. In the temple monkey forest of Padengtgal in Bali, Indonesia, 48 bites were observed within 6 weeks of observation [Fuentes & Gamerl, 2005]. Incidences in Singapore appear to be much lower, although rigorous comparisons across commensal regions are limited without a thorough assessment of the number of people and macaques interfacing and amount of area in which they interface.

In Singapore, we found a rate of 2.03 interactions per hour. This finding is much lower than in tourist areas in Gibraltar, where the interaction rates were found to be 99.6 [O'Leary & Fa, 1993] and 30.6 interactions per hour [Fuentes, 2006a]. This difference is likely because the interface in Gibraltar occurs in a small area densely packed with tourists and macaques, and people come to the area to directly interact with and feed the monkeys. The rate of aggressive interaction found in this study was 0.39 interactions per hour. This finding is lower than the rate of 4.67 aggressive interactions per hour in the temple monkeys of Bali [Fuentes, 2006b] but slightly higher than the urban macaques of Hong Kong (0.26 per hour) [Fellowes, 1992]. It appears that tourist site monkeys may have higher interactions rates than urban macaques.

Macaque Feeding

Provisioning can alter the behavior of macaques and lead to higher levels of interaction with people [Edington & Edington, 1986; Wheatley et al., 1996]. It is likely that historical food provisioning has been one factor contributing to the overlap between humans and macaques in Singapore. About a sixth of total respondents indicated that they were inclined to feed macaques, but it is worth noting that the proportion may be under-represented owing to reluctance by some respondents to admit to feeding macaques for fear of repercussions (i.e. fining by park service authorities that were administering the test). 75% of respondents indicated that they knew about the fine for feeding macaques, and a larger proportion of residents were more aware of the fine than visitors.

Residents were less likely to feed macaques than visitors, and we speculate that this is owing to more awareness of the feeding fine and better knowledge about the potential of their actions to exacerbate nuisance problems, owing to education efforts by Singapore's National Parks Board (NParks). Another factor is that residents are more influenced by the results of feeding and thus have greater incentives to avoid feeding in order to ameliorate human-macaque conflict. However, this is not to say that residents do not contribute to macaque feeding, and the minority of feeders may still be attracting macaques to remain in residential areas despite their neighbors' efforts. Visitors also feed macaques in residential areas. For example, they provide food from cars along roads and lay out food in areas where macaques frequent around residential areas, attracting them more to these areas. Therefore, despite residents' efforts, visitors also contribute to keeping macaques in residential areas. Consequently, fining efforts need to expand beyond park borders to protect residents affected by macaques and education efforts on the feeding ban and negative impacts of feeding on macaque ranging patterns should continue until feeding is eliminated.

As noted by Lucas [1995], we found that the motivation for humans to feed macaques is partly related to the notion that macaques do not have enough food in the forests, although the majority of feeding is likely for hedonic reasons (i.e. people enjoy it). The feeding ban has achieved some success, and 80% of the people interviewed perceived the feeding ban as being effective in curbing feeding. Also, when compared with past reports on the levels of feeding it appears that feeding has lowered from the 1980s, a time when visitors visited the parks to feed macaques for recreation [Lucas, 1995]. A small percentage of the respondents questioned the effectiveness of enforcing the feeding ban. These people expressed the need for heavier fines or alternative measures though education efforts, and their input is important to note because their comments reflect the reality that feeding still occurs in and around the reserves and parks.

NParks has attempted several strategies to increase the success of fining on curbing feeding of macaques. They have increased the cost of fines and have also launched education programs in the reserves to alert people of the feeding ban through signage and directly informing residents and visitors by approaching them or issuing pamphlets. The penalty for macaque feeding was increased from SGD\$200 to \$250 in 2007 and in 2008, the fine was raised to SGD\$500 [NParks, 2008]. NParks has also used closed-circuit television cameras along feeding "hotspots" to observe feeding and has also worked cooperatively with auxiliary police to assist in the issuance of feeding fines within park boundaries.

Human–Macaque Conflict in Singapore

The conflict between long-tailed macaques and people in Singapore has been highlighted as an escalating issue by the media and management authorities, and therefore has become an issue of public interest to Singaporeans in recent years [AVA/Nparks, 2005; Murdoch, 2007; Mulchand & Tan, 2008; Sua, 2007]. Overall, our results and others [Fuentes et al., 2008; Jones-Engel et al., 2006] on interactions between human and macaques have shown that Singapore might have one of the most benign human–macaque interfaces in the world. Therefore, the human–macaque conflict situation may be less severe than is depicted by media and management reports. Moreover, the majority of interview respondents do not seem to show any great animosity toward macaques, and the majority of people prefer management strategies that do not involve the removal of macaques. This situation could reflect the success of Singapore's efforts to manage their human–macaque interface over the past several years through educational and enforcement methods. Alternatively, it could also represent something intrinsic about the macaques, people, or habitat of Singapore. These questions make it critical to continue to increase our understanding of the human–macaque interface in Singapore in order to gain information that could later be used to aid people in other regions, who are attempting to understand and ameliorate their own human–macaque conflicts.

The human–macaque conflict situation directly affects only a small proportion of the Singaporean population, and is mainly affecting the lives of people that live on the fringes of forest patches. Despite this, it remains a challenge for management authorities to sufficiently address and curtail macaque nuisance problems in a way that satisfies the small percentage of affected persons, while also benefiting the general public's interest in their natural heritage commonwealth and maintaining a healthy and stable macaque population. Our interview survey showed a strong support for humane management options like conflict resolution through education and little support for the removal and eradication of macaques. These findings should be useful to management authorities in deciding how to best approach Singapore's human–macaque conflict, by understanding the perspectives of people living with macaques. Moreover, we must be careful to not allow biased press reports and media depictions of nuisance macaques generated from the complaints of a small proportion of the affected people living with macaques send the wrong information about the severity of human–macaque conflict in Singapore. Singapore indeed suffers from problems associated with humans living in close proximity with macaques, but the results of our study indicate the situation is manageable and there is ample public support for maintaining a macaque population.

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All research reported in this manuscript adhered to the American Society of Primatologists (ASP) Principles for the Ethical Treatment of Non Human Primates. Research protocols reported in this manuscript did not involve any laboratory manipulation of animals or animal parts and did not violate any wildlife protection acts in Singapore, where the research was conducted. All research reported in this manuscript adhered to the legal requirements of Singapore and has been approved by the National Parks Board Singapore.

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Fig. 1.

(a) The sites of human–macaque interface selected for this study. All sites occurred within Bukit Timah and Central Catchment Nature Reserves and are represented by picnic bench icons. (b) The location of public complaints about macaques during 2002–2007 as compiled from Agri-Food and Veterinary Authority (AVA) and National Parks Board (NParks) of Singapore in 2005.

TABLE I
Frequency of all macaque-to-human interactions observed at our six study sites in Singapore

Site	Frequency of interactions per hour of observation (%)								Total ^a
	Scratch or bite	Grab or take	Mobbing	Lunging and chasing	Facial or vocal threats	Affiliative/subversive gestures	Physical contact without aggression	Interactions with artificial environment	
Upper Peirce Reservoir Park (UPRP)	0.00	0.71 (28.9%)	0.00	0.33 (13.4%)	0.21 (8.5%)	0.96 (39.0%)	0.08 (3.3%)	0.17 (6.9%)	2.46
Rifle Range Road (RRR)	0.00	0.21 (12.6%)	0.04 (2.4%)	0.04 (2.4%)	0.13 (7.8%)	0.96 (57.5%)	0.00 (0.0%)	0.29 (17.3%)	1.67
Upper Seletar Reservoir Park (USRP)	0.00	0.21 (8.2%)	0.00	0.21 (8.2%)	0.33 (12.9%)	1.67 (65.6%)	0.00 (0.0%)	0.13 (5.1%)	2.54
MacRitchie Reservoir Park (MRP)	0.00	0.54 (23.5%)	0.04 (1.7%)	0.38 (16.5%)	0.25 (10.9%)	0.67 (29.1%)	0.13 (5.7%)	0.29 (12.6%)	2.29
Bukit Timah Nature Reserve (BTNR)	0.00	0.38 (22.5%)	0.00	0.04 (2.5%)	0.13 (7.5%)	0.54 (32.5%)	0.04 (2.5%)	0.54 (32.5%)	1.67
Lower Peirce Reservoir Park (LPRP)	0.00	0.13 (8.1%)	0.00	0.13 (8.1%)	0.17 (10.8%)	0.92 (59.5%)	0.00 (0.0%)	0.21 (13.5%)	1.55
Mean ^b	0.00	0.36 (17.8%)	0.01 (0.7%)	0.19 (9.2%)	0.20 (9.9%)	0.95 (46.9%)	0.04 (2.1%)	0.27 (13.4%)	2.03

^aTotal frequency of macaque-to-human interactions at each study site.

^bMean frequency of macaque-to-human interactions for each behavior investigated across all observation sites.

Interview questions used in the questionnaire distributed to residents and visitors in and around Bukit Timah and Central Catchment Nature Reserves

TABLE II

Questions (N respondents for question)	Visitors		Residents		Total (Visitors+Residents)		t-statistic ^a	p ^b
	N	%	N	%	N	%		
Attitude toward macaques (507)								
Strong or mild liking for macaques	141	36.8	26	21.0	167	32.9	3.386	0.0008
Neutral	182	47.5	58	46.8	240	47.4	0.155	0.8770
Strong or mild dislike for macaques	60	15.7	40	32.2	100	19.7	4.012	0.0000
Experienced nuisance problems (512)	96	24.4	86	68.3	182	35.5	5.942	0.0000
Type of problem experienced (182)								
Threats, follow/chase	33	34.4	25	29.1	58	31.9	0.820	0.4132
Theft of items	46	47.9	46	53.5	92	50.5	0.877	0.3816
Bites or scratches	17	17.7	2	2.3	19	10.5	3.407	0.0008
Property damage	0	0.0	13	15.1	13	7.1	3.973	0.0001
Perceived cause of problem (411)								
Attraction to food	159	53.8	82	71.3	241	58.6	5.178	0.0000
Natural playfulness	62	20.9	11	9.6	73	17.8	2.721	0.0068
Provocation by people	61	20.6	15	13.0	76	18.5	1.806	0.0717
Naturally aggressive	14	4.7	7	6.1	21	5.1	0.580	0.5625
Fed monkeys in past (507)	63	16.4	9	7.3	72	14.2	2.532	0.0116
Will feed monkeys in future (499)	76	20.1	8	6.6	84	16.8	3.484	0.0005
Knowledge of fine (500)	275	72.8	98	80.3	373	74.6	3.093	0.0021
Monkeys do not have enough food in the forest (478)	173	43.9	31	36.9	204	42.7	1.284	0.1999
Do you agree with the effectiveness of feeding ban (495)	305	80.5	87	75.0	392	79.2	2.963	0.032
Knowledge of conflict situation (396)	178	59.9	84	84.8	262	66.2	5.057	0.0000
Problem has to be urgently dealt with (484)	71	19.5	56	46.7	127	26.2	6.211	0.0000
How to manage the macaque problem? (503)								
Eradicate macaques	10	2.6	1	0.8	11	2.2	1.185	0.2366
Reduce population	29	7.6	26	21.5	55	10.9	4.309	0.0000
Remove nuisance monkeys	4	1.0	7	5.8	11	2.2	3.170	0.0016
Keep nuisance monkeys away from urban areas	82	21.5	24	19.8	106	21.1	0.638	0.5235

Questions (N respondents for question)	Visitors		Residents		Total (Visitors+Residents)		<i>t</i> -statistic ^a	<i>P</i> ^b
	N	%	N	%	N	%		
Education on co-existence with macaques	257	67.3	63	52.1	320	63.6	3.953	0.0001
Important to conserve and afford more protection to macaques (395)	245	88.1	101	87.1	346	87.6	0.276	0.7823

The percentage of responses to each question is reported for residents and visitors and the differences in response between residents and visitors are compared.

^a *t*-statistic for independent *t*-tests of difference between visitors and residents for each response.

^b Significance level at 95% confidence interval.

TABLE III

The time, location, and content of public complaints (direct quotes) directed to Singapore's National Parks Board (NParks) between January and October 2007

Date	Location	Feedback remarks
10-Jan-07	Casuarina Road	Monkeys from Lower Peirce Reservoir Park roaming into terraces (through backyard) to steal food over the last 3 weeks
16-Jan-07	Meng Suan Road	Monkey nuisance—request for trap to be set up
25-Jan-07	Admiralty Road	Monkeys losing their habitat due to construction of Republic Polytechnic are forced to roam into residential area. People are feeding them and the monkeys became aggressive, start to snatch food and might have the possibility of future attacks on people. The authority should look into planning before development. The remaining forest should be conserved before all native plants and animals become extinct
21-Feb-07	Springleaf Avenue	Monkeys feeding on banana plant in garden. Requested more banners and educational brochures to educate the residents
21-Feb-07	Lower Peirce Reservoir Park	Monkeys and birds are intruding residents' kitchens - stealing food and rummaging bins. Suggest more fruit trees to be planted
22-Feb-07	East Coast Park	A group of monkeys disturbing children and grabbing people's belongings. Requesting AVA to assist
23-Feb-07	Nemesu Avenue, Sembawang Hill Estate	Monkeys from Peirce Reservoir Park climbing rooftops to get across to resident's backyards to rummage bins and feed on plants
16-Mar-07	Bukit Timah Nature Reserve	Suggested a need for a systematic culling program of monkeys. Lives near Bukit Timah Nature Reserve and monkeys are a definite menace
21-Mar-07	Lakeview estate	Monkeys from MacRitchie Reservoir intruding estate and resident's units. Have advised residents not to feed monkeys. Is there a way to deter the monkeys from entering estate?
17-Apr-07	Beauty World complex	Monkeys from the forest crossing pedestrian bridge, grimacing at people and snatching their belongings. Morning and evening. Daily basis
30-Apr-07	Upper Peirce Reservoir Park	Food snatching monkeys
7-May-07	Jalan Pelatina	At least 20 monkeys are sitting along the steps (needed by residents) in the vicinity of Jalan Pelatina. These monkeys can be seen every Sunday. Can authority do something to rid these monkeys into the areas less used by residents?
10-May-07	Windsor Park	Report of many monkeys in the area. Twice entered my house, tried to jump at us instead of going out. Several mornings last week counted over 25 monkeys in my neighbor's garden! Monkeys spill over the dustbins and dirty the place. Already aware that we shouldn't leave any food at reach but is there any other recommendation you can give?
21-May-07	Bukit Timah Nature Reserve	Increase signage and step up enforcement around residential areas—monkeys are staying longer, getting bolder and attacking members of the public. It is a threat to children
22-Jun-07	British Club	3–4 different troops frequenting the compound. Requested Zoo to assist with darting, after which AVA will arrange for euthanasia
27-Jun-07	SICC golf club	Monkey attacks. Ask for suggestion
29-Jun-07	Marigold Drive	Taking their food everyday in the late morning till early afternoon
2-Jul-07	Peirce View Condo	Drivers along Old Upper Thomson Road had been feeding monkeys. Monkeys are venturing out from the nature reserves and foraging for food in the condo. Also swim in the pool. Monkeys getting daring & posing danger to children in the vicinity. Had advice from NParks but efforts have been futile
9-Jul-07	Nemesu Ave	Banana tree in courtyard. Many monkeys
13-Jul-07	Payar Lebar Airbase	Spotted 3 macaques—worry about safety of personnel and operations. Request for solution
28-Jul-07	Gladiora Drive	5–6 monkeys found in front of house and in the area.
6-Aug-07	Adam Drive	Too many monkeys coming out of MacRitchie and roaming in the area. Wants monkeys trapped
21-Aug-07	Taman Permata	Big troupe of monkeys intruding from MacRitchie Reservoir Park. Request for loan of monkey traps
Sep 07	Yishun Park	Steal food at Yishun Park
Sep 07	Bedok Reservoir	Snatching food at Bedok Reservoir Park

Date	Location	Feedback remarks
11-Sep-07	Jalan Keria	A monkey in the location and intrude into house
13-Sep-07	Le Wood Condo	Monkey snatch food and plastic at outside condo
21-Sep-07	Bukit Batok Nature Park	Near staircase to main road, about 10 monkeys
1-Oct-07	Upper Seletar	Monkeys attack old man

TABLE IV

Date, publisher, and headlines of newspaper articles about macaques and human-macaque conflict in Singapore between 2004 and 2008

News Headline	Publisher	Date
Monkeys in Singapore	Lian He Morning News	17 Jan 04
Monkey miracle in Bukit Timah	Shin Min Daily News	31 Jan 04
Hungry monkeys a threat to trail users	Today	10 Feb 04
Macaques aggressive, don't feed the monkeys	Streets	10 Feb 04
Monkey woes at air force base	New Straits Times	26 July 04
200 wild monkeys obstruct traffic waiting for a feed	Shin Min Daily News	5 Oct 04
3 monkeys killed by car in Bukit Timah	Shin Min Daily News	21 Jan 05
Monkeys in Taiwan and Singapore carry "deadly virus"	Lian He Morning News	7 Jun 05
Look, don't touch. Those fluffy monkeys can deliver a nasty bite	Straits Times	9 Aug 05
Public urged not to feed wild monkeys	Straits Times Forum	31 Jan 06
Despite all the warnings, people continue to feed the monkeys	Straits Times Forum Online	17 Feb 06
Feeding animals in the wild risky	The Straits Times	10 Mar 06
A monkey's letter to Singaporeans	Lian He Morning News	12 Mar 06
Passers-by stopped by wild monkeys in Jurong East	Shin Min Daily News	24 May 06
Monkeys entry house to "rob" for food	The Straits Times	19 Sep 06
Take action on motorists who feed monkeys at Upper Peirce Reservoir	Straits Times Forum	27 Sep 06
Undergrad suffers brain injury after monkeys cause crash	Straits Times	1 Oct 06
Monkeys creating havoc at Windsor Park estate	Straits Times Online	3 Oct 06
Step up patrols to stop people feeding the monkeys	Straits Times Online	4 Oct 06
Monkeys in nature reserve not a threat to people	Straits Times Online	5 Oct 06
Monkeys in parks are becoming more aggressive	Straits Times Online	5 Oct 06
Monkey havoc: Man, not animals, the real culprit	Straits Times Online	7 Oct 06
Argh, monkeys stole my cake	The Straits Times	8 Oct 06
Don't feed monkeys, it does them harm	Straits Times Online	9 Oct 06
Punish monkey feeders	Straits Times	14 Oct 06
Monkey found in Ang Mo Kio housing estates	Shin Min Daily News	15 Oct 06
Monkeys torment Bukit Timah residents	The Newspaper	21 Nov 06
Residents at Bukit Timah harassed by monkeys	Lian He Evening News	25 Nov 06
Install CCTV to stop people feeding monkeys	Straits Times Forum	1 Jan 07
Stressed Singaporeans crack down on thieving monkeys	The Star	19 Feb 07
When feeding monkeys = loving them to death	The Straits Times	21 May 07
Wild monkeys creating nuisance at Toa Payoh	Shin Ming Daily News	26 May 07
Adult male monkey roaming near Pasir Ris canal	Shin Ming Daily News	12 June 07
Monkeys downgrading to heartland	The New Paper	5 July 07
Wild monkeys create nuisance at Woodlands	Shin Ming Daily News	8 July 07
Wild monkeys create nuisance at Woodlands, chasing 2 years old child	Shin Ming Daily News	11 Aug 07
Mother monkey hurt, young monkey wails	Lian He Evening News	9 Sep 07
Incident at Marsiling—wild monkey climbs up car and steals tidbits from store	Shin Ming Daily News	9 Sep 07

News Headline	Publisher	Date
Feeding monkeys harm them and does not benefit yourself	Lian He Morning News	9 Sep 07
Monkey mayhem at MacRitchie reservoir	Straits Times	29 Dec 07
They're still feeding monkeys	Straits Times	31 Dec 07
Natural to feed the monkeys? Educated adults should know better	Straits Times Forum	2 Jan 08
\$4,000 fine for feeding monkeys	Straits Times	24 Jan 08
Feeding monkeys? Fine doubled to 500	Straits Times	1 Feb 2008
Monkey Mayhem in Bukit Timah	The New Paper	12 Mar 08
More monkeys caught in AVA traps	Straits Times	22 Mar 08
How macaques and humans can live together	Straits Times	25 Mar 08