

## SURVEY FOR SEMI-TAME COLONIES OF MACAQUES IN THAILAND

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### A B S T R A C T

A survey of semi-tame colonies of macaques near human habitations was undertaken to give a broader picture of their distribution outside of forest conservation areas in Thailand, and to assess their possibilities for survival. In the survey, population size and age-sex composition, ranging behavior, habitat available, amount of provisioning by humans and attitudes of local people were assessed. Eight study sites were selected for brief study of the macaques' ecology and behavior.

A total of 52 sites were visited. There were 42 free-ranging colonies, two sites with captive animals only, and eight sites with both free-ranging and captive monkeys. The age-sex composition of the monkeys was observed in 36 sites. At least 2,728 macaques were observed at 36 sites, including 2,538 *Macaca fascicularis* (33 colonies), 103 *M. mulatta* (one colony), 56 *M. assamensis* (one colony), and 31 *M. arctoides* (one colony)

Twenty-one of the sites visited had colonies now completely isolated from other populations of the same species. These colonies therefore could be at risk of extinction over the long term from demographic fluctuation, inbreeding and local habitat loss. The effective population size ( $N_e$ ) of 14 sites was below 50 breeding individuals.

At 19 of the sites monkeys received some provisioning from visitors, six sites were almost fully dependent on provisioning, and eleven sites were occasionally provisioned. Overall, the monkeys looked healthy (without hair loss or malnourishment) at 31 sites, three sites had obese monkeys, and two sites had undernourished monkeys.

Those monkeys living at tourist sites fed more on provisioning food. Monkeys at heavily provisioned sites used artificial (man-made) substratum more than those at less provisional sites. At the eight selected sites, the monkeys' home range varied from 5 to 125 ha (mean = 52).

To conserve the monkeys or other wildlife, natural habitat must be protected because it provides living space, food sources and refuges. Provisioning of free-ranging colonies is not necessary where natural habitat is available. Provisioning causes the monkeys to become less active, more aggressive towards human, and less healthy. In very limited areas, provisioning with fruits and vegetables can help the monkeys survive but people should avoid giving them high carbohydrate food. Further research on potential inbreeding should be carried out to determine the need for active management of small isolated monkey colonies.

### I N T R O D U C T I O N

Non-human primates have not been thoroughly surveyed in most parts of Thailand. Most information on presence and relative abundance has come from protected areas (national parks and wildlife sanctuaries), and even this information is sparse. Furthermore, most available knowledge is outdated (KLOSS, 1916a, b, 1917; GLYDENSTOLPE, 1919;

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CHASEN, 1935; CARPENTER, 1967; LEKAGUL & MCNEELY, 1977; MEDWAY, 1978; STORER, 1978; FOODEN, 1976a, b, 1980, 1982a, b; EUDEY, 1991). Only more recent reports give accurate locations of sites surveyed (CHAWALSILP, 1981; MEESWAT, 1981; BROCKELMAN & GITTINS, 1984; MARSHALL, 1981; MARSHALL, ROSS & CHANTHAROJVONG, 1984; MARSHALL, SUGARDJITO & MARKAYA, 1984; SRIKOSAMATARA, 1980, 1984; BOONRATANA, 1988; TREESUCON, 1988). A recent study of long-tailed macaques (*Macaca fascicularis*) in Thailand was made by P. Varavudhi and coworkers (HARIHARA *et al.*, 1991; KAWAMOTO *et al.*, 1989; SUZUKI & VARAVUDHI, 1989; TAKENAKA *et al.*, 1989; Varavudhi *et al.*, 1989a, b, 1992). They studied endocrinology, population genetics, and virology of the long-tailed macaques at nine semi-tame colonies in Thailand during August to September, 1988. The study sites were Khao Tang Kuan and Wat Tham Khuha Sawan (lower peninsula); Kosumpho Forest Park and Wat Koo Pra Kona (northeast); Wang Kaew (southeast); Wat Khao Noh, Wat Ratch Singkhorn, Wat Huai Takhaeng and Wat Tham Chomphon (central).

Increasing human populations have caused severe decreases in non-human primate populations. Forest destruction has caused shrinking of natural vegetation and diminishing food supply and living space for primates. Frequent contact with humans has caused many non-human primate populations to be locally hunted out as a source of protein, or for the animal trade (NICHOL, 1987).

Some macaque and langur species adapt well to the presence of humans, occupying small patches of habitat near villages, towns, cities, and particularly at temples (SOUTHWICK, BEG & SIDDIQI, 1961a; SOUTHWICK & SIDDIQI, 1968; EIMERL & DE VORE, 1974). Their ecological tolerance and behavioral adaptability are undoubtedly factors in the macaques' ability to survive in areas of major human modifications. Equally important is the tendency for humans to tolerate and protect the monkeys at some religious sites.

These semi-tame colonies of macaques in temples are protected by Section 25 of the Wildlife Conservation Act, 1960, which states that no one is allowed to kill, harm or collect wildlife, their eggs or nests in temples or in any religious sites. There is, however, no supervision by the Royal Forestry Department where these macaques are found outside of protected forests and parks, and there is no other agency which has any formal responsibility for the colonies. Many of these macaques suffer from ill-health due to poor diet resulting from provisioning with high carbohydrate food. These macaques usually have low colony sizes and little or no dispersal between them, bearing implications on possible inbreeding (MERRELL, 1981; GOODMAN, 1987; FOOSE, 1992a; b).

A survey for semi-tame colonies of macaques near human habitations was initiated to give a broader picture of their distribution in Thailand. Such colonies represent the only wild primates which still occur in the central plains and coastal areas occupied by humans. The survey was carried out not only to determine population size and age-sex composition, but also to obtain information having conservation implications such as attitudes of local people, availability of natural cover and area use.

The macaques are not only important for conservation, but they are important to the people who live there. They are the only free-ranging primates that people commonly see. The animals are a part of Thai culture, and they appear in nursery rhymes, folk songs, and other Thai folklore (KRIENKRAIPETCH, 1989). Furthermore, the macaques could be very important in research because they are easy to study and many of their physiological traits are similar to those of humans.



Figure 1. Note tail length of *M. fascicularis* at Khao Sam Muk, Chonburi Province (southeast Thailand).



Figure 2. A very short tail of a female *M. arctoides* which was introduced to Wat Tham Pla, Chiang Rai Province (north Thailand).



Figure 3. Tail length of an adult female *M. assamensis* at Wat Tham Pla, Chiang Rai Province.



Figure 4. A Buddhist temple, Wat Khuha Phimuk, Yala Province in south Thailand showing a “bot” (the big building) and a “sala” (the small one).

Eight study sites were selected for brief study of the macaques' ecology and behavior (Table 3). The selection was based on the species and habitat characteristics. An understanding of their socio-ecological adjustments will be meaningful to the long term conservation of these colonies. The behavioral observations are only summarized briefly in this report.

The family Cercopithecidae (Old World monkeys) includes 14 genera and 70 species; however only four species of langurs (*Presbytis* spp.; *Trachypithecus* spp.) and five species of macaques (*Macaca* spp.) are found in Thailand (LEKAGUL & MCNEELY, 1977; EUDEY, 1987; GROVES, 1989). There is only one semi-tame colony of *Trachypithecus obscurus*, found in Wat Khao Phlu, Chumphon Province (lower peninsula) and one colony of *T. phayrei* in Wat Tham Pa Pu, Loei Province (northeast Thailand). Four species of macaques may be found locally in semi-tame colonies. They are *M. fascicularis* (Figure 1), *M. mulatta*, *M. arctoides* (Figure 2) and *M. assamensis* (Figure 3). Some *M. nemestrina* have been introduced to colonies of the other macaques.

### Buddhism, Culture and Conservation

Thai culture is strongly influenced by the Buddhist religion. Actually Buddhism is an “understanding of nature”, and is also called a “religion of nature” (LAOHAVANICH, 1989). Even though Buddhists believe that the highest form of life is human life, Buddhist monks are prohibited from harming animals and plants because they respect the rights of

other living things (LAOHAVANICH, 1989). During Buddhist lent (May-July), the monks are not allowed out of their monasteries, to avoid stepping on small animals.

There are two sects of Buddhism in Thailand, the "Mahanigai" sect and the "Thammayut" sect. The Religious Affairs Department reported that there were 29,002 temples in Thailand in 1990. The temples are separately administered by the different sects. About 27,659 temples belong to the Mahanigai sect and the other 1,343 temples belong to the Thammayut sect. Most of the monks in Thailand belong to the Mahanigai sect, which is less conservative than the Thammayut sect, usually having temples in more urban areas. There were 265,165 monks, 111,668 novices and 16,909 nuns belonging to the Mahanigai sect in 1990. Their daily routines include chanting of Buddhist verses and lessons in Pali. Most often they are called upon to perform ceremonies, festivities and preach to the local community.

The Thammayut sect is a minority sect which was started by King Rama IV (King Mongkut) and it has stricter practices than the Mahanigai sect. Their temples are usually located near or in the forest. There were 23,472 monks, 11,975 novices and 3,105 nuns belonging to this sect in 1990. They lead a highly disciplined life, emphasizing individual meditation (PRAMUAN SARN & ALLISON, 1967; CUMMINGS, 1987).

In the rural areas, the temple or monastery is the center of religious activities in Buddhist societies and often the center of community activities. Temples are usually located on or near hills, or have forested areas to give the idea of a single and continuous existence with nature. The peaceful and quiet atmosphere provides an ideal place for the monks to meditate.

A Thai Buddhist wat or "temple" differs from most other religious places of worship in that it does not consist of only a single building. There is one major building meant for prayers. It is not uncommon, however, to find some temples with several prayer buildings. Then, there is the usual assortment of "chedi" (pagodas), "kuttis" (small homes for individual monks, novices and nuns), "salas" (open pavilions used for resting, monastic meetings and meditation) and a cremation ground. Figure 4 shows the "bot" (a big building) and "sala" (a small one) at Wat Khuha Phimuk, Yala Province. The idea of a Thai Buddhist temple is usually a large enclosed area comprising all the above and some natural and introduced vegetation. The whole temple area is venerated and it is blasphemous even to have ill thoughts in the area. Thai Buddhists strongly believe that misfortune will befall those entertaining such thoughts in the temple compound.

There are special days which depend on the lunar calendar known as "Wan Phra" (Buddhist monk days). On these days, many Thai people can be seen making merit by releasing captive birds, turtles, etc. even though most of these animals will be caught again by the sellers (PRAMUAN SARN & ALLISON, 1967; BURI, 1989; LAOHAVANICH, 1989; RABINOWITZ, 1991). Pigs and cows with abnormalities and various wild animals are donated to temples in order to gain merit, but more likely to get rid of the animals. Moreover, some temples keep wildlife to attract more merit-makers (RABINOWITZ, 1991). Some temples can also provide some protection to wildlife in nearby forests since many temples or forest monasteries maintain a "khet aphai than" —a sanctuary for protection of plants and animals (BROCKELMAN, 1989).

Thai people regard the forest with fear and reverence. They believe that there are spirits, "Rukha Thevada", which live in big trees and a spirit, "Chao Pho", which lives in

the forest to protect the forest and animals from being disturbed (BURI, 1989; KRIENCKRAIPETCH, 1989; VICHIT-VADAKAN, 1989). Many temples provide protection to the forest because of the villagers' fear of the spirits (BURI, 1989).

Unfortunately, however, Buddhist practices toward other living things are not applied so strictly away from temple areas. Moreover, Thai Buddhism is noted for its tolerance for deviation from principles when people are in need of subsistence. For these reasons, the temples of Thailand often become small refuges for adaptable species which have become eliminated from forests elsewhere by hunters.

### M A T E R I A L S   A N D   M E T H O D S

Since most monkeys that occur outside protected areas are probably in temples and forest monasteries, questionnaires were sent out to the head abbot for each sect of each province. Out of a total of 166 questionnaires mailed out, I received 41 replies (35%); 18 of which indicated the presence of non-human primates.

From information gathered from various other sources, a total of 68 possible sites was established (Table 1). I was able to visit 53 of the sites, and received information on the remaining sites on completion of the study. Forty-two of the sites visited had free-ranging monkeys only, two sites had captive monkeys, and eight sites had both free-ranging and captive monkeys.

This study was carried out in two phases. During Phase I, a population survey was carried out to confirm the presence of non-human primates at the sites reported (Table 2). During Phase II, a short study of behavior at eight selected sites was carried out (Table 3).

Table 1. Number of visited sites for semi-tame colonies of non-human primates in Thailand, 1989-1991.

Region	Reported sites	Visited sites		Monkeys present			
				once	twice	Free ranging only	Captive only
North	3	1	1	1	-	1	2
Northeast	15	7	3	8	1	1	10
Central Plains	26	18	1	14	1	4	19
Southeast	6	3	-	3	-	-	3
Upper peninsula	11	7	5	10	-	1	11
Lower peninsula	7	6	1	6	-	1	7
Total	68	42	11	42	2	8	52

Table 2. List of locations visited and dates, 1989-1991. UTM grid coordinates and 1 : 50,000 sheet numbers are given under location.

No.	Location	Days Visited
1.	Khao Noi/Khao Tang Kuan, Songkhla. (761971/5123 III)	Apr. 9-14, 89
2.	Wat Tham Sala, Nakhon Pathom. (207268/5036 IV)	May 12, 89
3.	Sarn Pra Karn, Lopburi. (741368/5138 IV)	June 22-23 & July 7-9, 89
4.	Wat Khao Wong Kot, Lopburi. (665606/5139 III)	June 24, 89
5.	Wat Pa Laelai, Suphanburi. (183001/5037 IV)	July 7, 89
6.	Wat Noi Chompoo, Suphanburi. (243141/5038 III)	July 7, 89
7.	Ban Wan, Si Saket. (128002/5839 IV)	July 12-14, 89
8.	Wat Ban Kan Yai, Si Saket. (166979/5839 IV)	July 14, 89
9.	Wat Koo Pra Kona, Roi Et. (739199/5740 II)	July 14-16, 89
10.	Don Poo Tao, Yasothon. (325418/5840 I)	July 16-17, 89
11.	Prang Koo, Yasothon. (343329/5840 II)	July 17-18, 89
12.	Kumpawapi Park, Udon Thani. (888928/5643 III)	July 18-20, 89
13.	Kosumphi Forest Park, Maha Sarakham. (943968/5641 III)	July 21, 89
14.	Wat Khao Bandai It, Phetburi. (009483/4935 II)	Aug. 10-11, 89
15.	Khao Wang, Phetburi. (020490/4935 II)	Aug. 12-13, 89
16.	Wat Bun Thawi, Phetburi. (014519/4935 II)	Aug. 18, 89

Table 2 (continued)

No.	Location	Days Visited
17.	Wat Kut, Phetburi. (030538/4935 II)	Aug. 19, 89
18.	Wat Ban Rai Don, Phetburi. (007497/4935 II)	Aug. 20, 89
19.	Wat Khao Takrao, Phetburi. (016611/4935 II)	Aug. 21, 89
20.	Wat Tham Pla, Chiang Rai. (905479/4949 I)	Sep. 14-16, 89
21.	Wat Tham Tab Tao, Chiang Mai. (128738/4848 III)	Sep. 17-18, 89
22.	Wat Khao Tao Mo, Phetburi. (806145/4934 III)	Sep. 22-23, 89
23.	Wat Cha-Am Kiri, Phetburi, (045152/4934 I)	Sep. 16, 90
24.	Wat Khao Takieb, Prachuab Kirikhan (070833/4934 II)	Sep. 16-17, 90
25.	Wat Thammikaram Varaviharn, Prachuabkirikhan. (873060/4932 I)	Sep. 17, 90
26.	Wat Tha Mai Lai, Chumphon. (970605/4929 I)	Sep. 18, 90
27.	Wat Tham Suwan Khuha, Phangnga. (421315/4625 I)	Sep. 19, 90
28.	Wat Tham Sua, Krabi. (916975/4725 II)	Sep. 19-20, 90
29.	Wat Khuha Sawan, Phatthalung. (195422/5025 III)	Sep. 20-21, 90
30.	Wat Khuha Phimuk, Yala. (462219/5222 III)	Sep. 21-22, 90
31.	Khao Sam Muk, Chonburi. (065727/5135 I)	Nov. 10-14 & Nov. 16, 90
32.	Ko Sichang, Chonburi. (974537/5135 II)	Nov. 15, 90



Table 2 (continued)

No.	Location	Days Visited
33.	Ko Khangkao, Chonburi. (965502/5135 II)	Nov. 15, 90
34.	Wat Khao Phlu, Chumphon. (352859/4830 II)	Dec. 1-2, 90
35.	Khao Teen Ped, Chumphon. (355861/4830 II)	Dec. 1-2, 90
36.	Wat Tham Sala, Nakhon Pathom. (207268/5036 IV)	Dec. 15-19, 90
37.	Wat Tham Kunchorn, Ratchaburi. (766910/4935 IV)	Dec. 19, 90
38.	Tham Chomphon, Ratchaburi. (642058/4936 III)	Dec. 20, 90
39.	Wat Khao Chong Phran, Ratchaburi. (838165/4936 II)	Dec. 20, 90
40.	Wat Khao Khang, Ratchaburi. (825150/4936 II)	Dec. 20, 90
41.	Wat Ngern Rung Sawang, Ratchaburi. (825150/4936 II)	Dec. 20, 90
42.	Wat Huai Takhaeng, Ratchaburi. (825017/4936 II)	Dec. 20, 90
43.	Wat Khao Khan Hok, Kanchanaburi. (692301/4936 IV)	Dec. 22, 90
44.	Khao Suan Luang, Ratchaburi. (812024/4936 II)	Dec. 24, 90
45.	Wat Ratch Singkhorn, Ratchaburi. (843004/4936 II)	Dec. 24, 90
46.	Wat Khao Yod Thong, Ratchaburi. (782885/4935 IV)	Dec. 25, 90
47.	Wat Phra Buddha Chai, Saraburi. (103991/5137 I)	Jan. 11, 91
48.	Wat Khao Sompod, Lopburi. (469745/5239 II)	Jan. 11, 91
49.	Kosumphi Forest Park, Maha Sarakham. (943968/5641 III)	Jan. 12, 91

Table 2 (continued)

No. Location	Days Visited
50. Kumpawapi Park, Udon Thani. (888928/5643 III)	Jan. 12-14, 91
51. Wat Tham Khuha Varee, Loei. (161008/5343 II)	Jan. 15, 91
52. Wat Tham Pa Pu, Loei. (881454/5344 III)	Jan. 15, 91
53. Wat Koo Pra Kona, Roi Et. (739199/5740 II)	Jan. 17-18, 91
54. Wat Khao Tamon, Phetburi. (007497/4935 II)	Feb. 4, 91
55. Wat Khao Tao Mo, Phetburi. (806145/4934 IV)	Feb. 4-8, 91
56. Wat Khao Krapuk, Phetburi.	Feb. 8, 91
57. Khao Wang, Phetburi. (020490/4935 II)	Feb. 9-10, 91
58. Wat Khao Bandai It, Phetburi. (009483/4935 II)	Feb. 11, 91
59. Wat Bun Thawi, Phetburi. (014519/4935 II)	Feb. 11, 91
60. Wat Khao Takhrao, Phetburi. (016611/4935 II)	Feb. 11, 91
61. Wat Tham Pla, Chiang Rai. (905479/4949 I)	Feb. 17-21, 91
62. Wat Krieng Krai Klang, Nakhon Sawan. (278398/5040 III)	Feb. 22, 91
63. Wat Khao Noh, Nakhon Sawan. (942628/4940 I)	Feb. 22, 91
64. Wat Khuha Sawan, Phatthalung. (195422/5025 III)	Feb. 26-28, 91

Table 3. List of sites selected for behavioral study.

Site, region	Species	Dates studied	Habitat type	Tourists
Wat Koo Pra Kona, Northeast	f	Jan. 17-18, 91	Dipterocarp forest out of town	Some
Khao Sam Muk, East	f	Nov. 10-14 & Nov. 16, 90	Forest over limestone hill	Many
Wat Tham Sala, Central	f	Dec. 15-19, 90	Very limited habitat, trees scarce, surrounded by villages	Some
Khao Wang, Upper peninsula	f	Feb. 9-10, 91	An old palace on limestone hill in town	Many
Wat Tham Khuha Sawan, Lower peninsula	f	Feb. 26-28, 91	Forest over limestone hill in town	Some
Wat Tham Pla, North	as	Feb. 17-21, 91	Forest over limestone hill surrounded by villages & paddy field	Many
Kumpawapi Park, Northeast	m	Jan. 12-14, 91	Limited habitat in town	Some
Wat Khao Tao Mo, Upper peninsula	ar	Feb. 4-8, 91	Forest over limestone hill out of town	Some

f - *Macaca fascicularis*as - *Macaca assamensis*ar - *Macaca arctoides*m - *Macaca mulatta*

### Population Survey

The population survey study was carried out from April, 1989 to February, 1991, to confirm the presence of non-human primates at the reported sites. From one to four days were spent at each site, depending on the amount of time required to obtain the information sought.

At each site, the following information was collected: population size, age and sex distribution of any free-ranging groups present, degree of provisioning with food, natural food plants available, general appearance and health, habitat available for the group. The abbot and other monks were interviewed to obtain information on the origin and history of the monkeys, legal status of the habitat and attitudes of the local people toward them. The presence of other wild and captive or caged mammals was also noted. Monkeys were aged into the classes infant, juvenile, subadult and adult using criteria defined by the NATIONAL RESEARCH COUNCIL (1981), NEVILLE (1968) and VARAVUDHI (1989a).

### Behavioral Observations

Behavioral observations were carried out at the eight sites from November, 1990 to February 1991. The sites were selected to include all species of monkeys found, all habitat types, and all regions of the country (Table 3).

Behavior of the primates was recorded using the scan sampling method (ALTMANN, 1974; BENNETT, 1983; MARTIN & BATESON, 1986). Scans were carried out for a continuous 15 minutes to include as many individuals as possible in every 15-minute block from dawn to dusk. Behavioral activities were recorded on the third second after sighting the animal to reduce bias towards eye-catching activities (BENNETT, 1983).

The following behavioral categories were used: rest, locomotion, feed, suckle (infants), groom, play, agonism, copulation. Food was identified when possible. The nearest neighbor of each animal and distance away were also recorded. Substrate type was noted. The daily activity of each age-sex class was summarized as the percentage of time engaged in each activity in each hour of the day. A resurvey of population and group size, including age/sex composition was carried out about six months after the initial observation visit. This was to observe demographic changes, if any. Behavior data were summarized using Systat statistical software on PC.

A major objective of this study was to evaluate the long-term trends and viability of the monkey colonies. This evaluation was based on the health of primates, degree of provisioning, attitude of humans toward the primates and status of the habitat. Total population and effective population size were also evaluated. Effective population size (WRIGHT, 1968; LANDE & BARROWCLOUGH, 1987; LANDE, 1988) in the size of an "ideal" reproducing population with an ability to maintain genetic variation equal to the actual one. It may be calculated from

$$N_e = \frac{4N_m N_f}{N_m + N_f}$$

where  $N_m$  = number of adult males and  $N_f$  = number of adult females in the population.

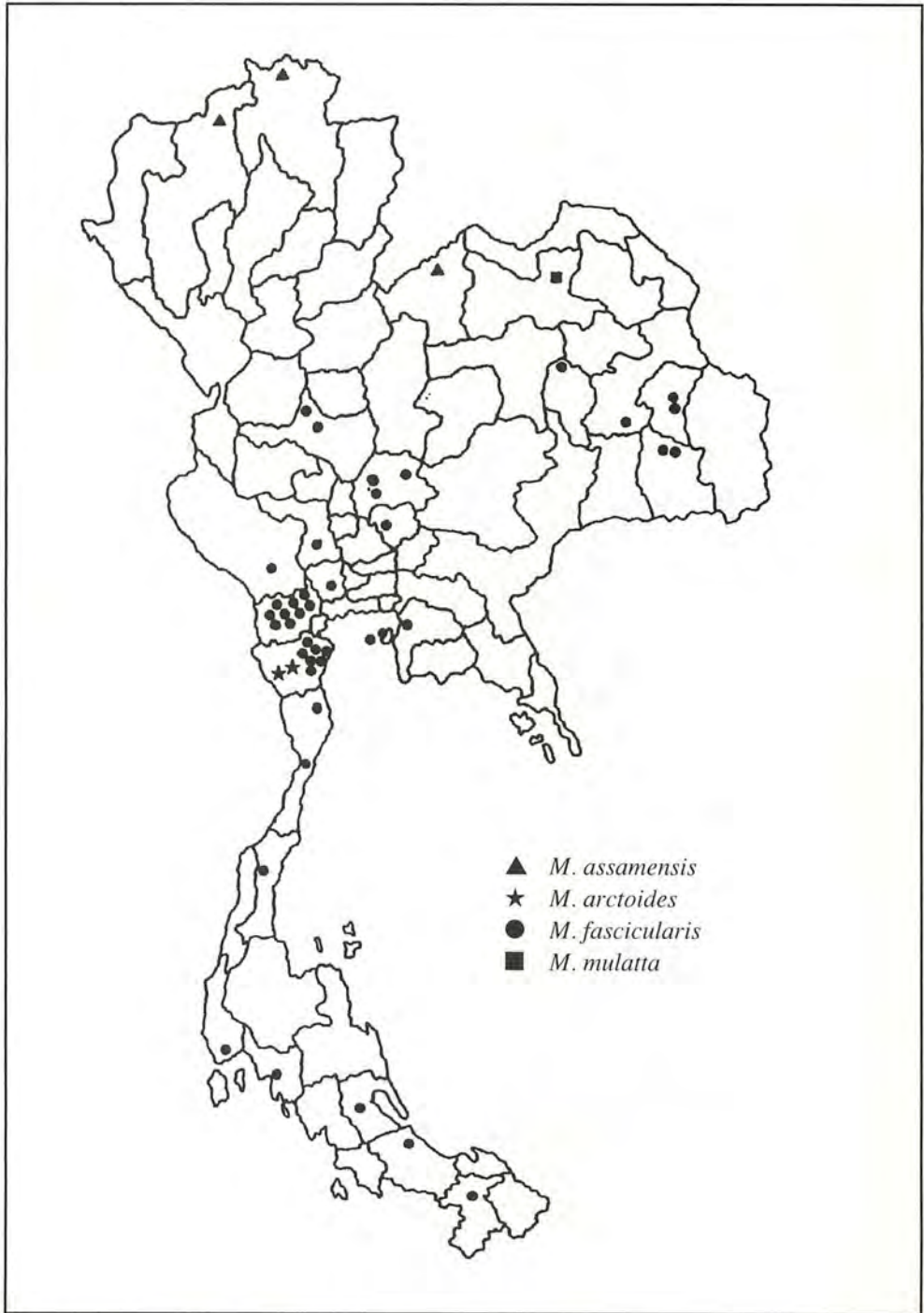


Figure 5. Location of semi-tame colonies of macaques in Thailand, 1989-1991.



Figure 6. Location of eight selected sites.

Such a calculation assumes that all reproducing adults have an equal expectation of being parents of any given progeny. This may be a reasonable assumption if we consider life-time reproductive success.

## POPULATION SURVEY

Descriptions of the 54 sites I visited are given below. The locations and species of semi-tame colonies of macaques are shown in Figure 5, and the list of locations visited with dates during this survey is given in Table 2. The population size, age and sex composition, sex ratio of the adults and index of reproduction (RI) of these primates for first and second visits are given in Table 4. Names of other animals mentioned in the text are listed in Appendix I (COX, 1991; LEKAGUL & MCNEELY, 1977; LEKAGUL & ROUND, 1991; SETHAPUTRA, 1986). Food plants of the monkeys were identified as well as possible from local names (SMITTINAND, 1980; SUVATI, 1978), but as specimens were not collected no authoritative list of plants was obtained.

### NORTH THAILAND

#### **Wat Tham Pla, Chiang Rai Province**

**Site** : Wat Tham Pla (408 m msl; 17.6 ha) is a Buddhist temple located at the base of a forested limestone hill, Khao Tham Pla (683 m msl; 90 ha) in Amphoe Mae Sai. The limestone hill is under the Forestry Department. The temple consisting of a pagoda, a "bot" and four "kutis" (meditation huts). A stream that flows out of a cave has both native and introduced fishes. There were three monks, a nun and a novice in this temple in 1991. The temple receives visitors and merit-makers regularly.

**Habitat** : The hill is covered by dense scrub forest (Figure 7). *Balanostreblus ilicifolia* trees grow on the hill. Some crop fields and villages surround the hill.

**Monkeys** : The monkeys here are *Macaca assamensis*, the only habituated group known so far in Thailand. There were 36 macaques seen in September, 1989 and 56 were counted in February, 1991. The monkeys ranged over about 94 ha, including the hill and part of the temple ground. They were provisioned with bananas, rice, crackers, peanuts and popcorn by visitors. The monkeys also fed on wild foods such as pods and leaves of tamarind, rain tree, and leaves of pomelo and *Balanostreblus*. The monkeys sometimes stole maize, sorghum, sweet potatoes and eggplants grown in the temple ground. There was no real threat to the monkeys since they received protection from the temple unless they traveled outside the grounds.

#### **Wat Tham Tab Tao, Chiang Mai Province**

**Site** : Wat Tham Tab Tao (580 m msl) is a forest monastery covering an area of 14.4 ha in Tambon Si Dong Yen, Amphoe Phang. The temple is located at the foot of a forested limestone hill which is under the Forestry Department. There were 28 monks and 6 nuns in this temple.

**Habitat** : Dense scrub forest covers the hill.

**Monkeys** : The chief monk informed me that there were wild *M. assamensis* on the hill but they stayed up there because of hunting by villagers. However, the monkeys came

down to a small stream near the temple in the dry season.

**Other wild animals** : Common wild boar, white-handed gibbons, bats, civets, flying squirrels, squirrels and red junglefowl are reported seen on the hill by the monks.

**Captive animals** : There were three *M. assamensis*, one *M. fascicularis* and one *Trachypithecus obscurus* in the temple in September, 1989. An adult male *M. assamensis* was caged, and a juvenile male *M. assamensis* and an adult *T. obscurus* were chained to poles. The leaf monkey came from Chachoengsao Province, eastern Thailand. An adult male *M. fascicularis* and an infant female *M. assamensis* were free to move about the monastery. The monkeys were given to the monastery by persons who wanted to gain religious merit, but the chief monk said that merit making in this manner was just an excuse to get rid of the monkeys. These captive monkeys feed on rice, banana and young leaves of *Erythrina* spp.

## NORTHEAST THAILAND

### Wat Tham Khuha Varee, Loei Province

**Site** : Wat Tham Khuha Varee (400 m msl) is at the foot of the mountain "Phu Pas Sana" (565 m msl) in Amphoe Wang Saphung. The hill is under the Forestry Department. This temple, founded in 1971, covers an area of 13 ha excluding the mountain.

**Habitat** : Dense forest covers an area of about 5 km<sup>2</sup> of the mountain.

**Monkeys** : About 13 Assamese macaques (*M. assamensis*) were reported by the monks. These monkeys seldom come down from the limestone hill. The monks informed me that the population of the monkeys has decreased due to hunting by villagers.

**Other wild animals** : Large mammals such as elephants and tigers were reported on the mountain as late as 1971. Other animals reported were civet, water monitor lizard, porcupine and red junglefowl.

**Captive animals** : A pig-tailed macaque was chained in the temple. The monkey was given by a villager.

### Wat Tham Pa Pu, Loei Province

**Site** : Wat Tham Pa Pu (300 m msl) is located on the foot of "Phu Foi Lom" (512 m msl) in Amphoe Muang Loei. Founded in 1932, this temple covers an area of 48 ha. About 30 nuns were in residence.

**Habitat** : The forest on the limestone hill covers an area of more than 10 km<sup>2</sup>, and is reserved forest under the Forestry Department.

**Monkeys** : About 15 Phayre's leaf monkey (*Trachypithecus phayrei*) were reported. These monkeys come down from the hill to feed on provisioned food such as bananas. The natural foods included pods and leaves of tamarind, etc.

### Kumpawapi Park, Udon Thani Province

**Site** : Kumpawapi Park (170 m msl; 0.8 ha) is a small public park in Ban Dong Muang, Amphoe Kumpawapi.

**Habitat** : Some parts of the park are covered with big trees such as rain trees (*Samanea saman*), tamarind, etc., which are used by the monkeys as sleeping sites (Figure 8).



**Monkeys** : The monkeys found here are *Macaca mulatta*, the only habituated group found so far in Thailand. The monkeys, however, may be a mixed population between *M. mulatta* and *M. fascicularis* because their tails are rather variable in length (P. Varavudhi, *pers. comm.*). There were 127 individuals in July, 1989, and 103 when counted in January, 1991. Monkeys' range was about 20 ha and included the park, a primary school and houses around the park. Since the park and the monkeys were protected by the town municipality, they were provided with glutinous rice twice a day. Three sacks of rice were allocated to the monkeys monthly. Throughout the day the monkeys received fruits, peanuts and sweetmeats from locals and visitors who came to the park. The monkeys appeared obese, probably from the high carbohydrate foods they received. However, they also fed on tamarind and some other leaves found in the park. The monkeys spent sometimes in the school, especially on weekends and school holidays, to feed on flowers of roses, jasmine, hibiscus, African marigold, quassia, *Ixora coccinea* and pods of *Acacia auriculiformis*, etc. The monkeys sometimes stole food from houses. The only threat seen was an occasional boy throwing stones at the monkeys.

#### **Wat Pa Laelai, Udonthani Province**

**Site** : Wat Pa Laelai is located near Ban Chiang Natural Museum in Amphoe Nong Harn.

**Habitat** : The temple is surrounded by villages and rice fields.

**Monkeys** : There are no free-ranging macaques in this temple.

**Captive animals** : The captive animals in this temple included a juvenile female *M. nemestrina*, an infant male *M. fascicularis*, a juvenile gibbon (unknown species), a pair of lesser mouse deer, common palm civet, masked palm civet, Malayan porcupine, Javan mongoose, tree squirrels, ground squirrels, and birds such as three pairs of green peafowl, a brown hornbill, an Oriental pied hornbill, etc. The abbot intended to educate the villagers, particularly children, about various forms of wildlife. The abbot bought some of the animals in Mukdahan Province which borders Laos. Most of the animals, however, were given by villagers.

#### **Kosumpho Forest Park, Maha Sarakham Province**

**Site** : Kosumpho Forest Park (150 m msl) covers an area of 20 ha in Ban Khum Klang, Amphoe Kosum Phisai. This park is situated close to the town and thus the monkeys here, *M. fascicularis*, enter the nearby houses. This park is under the care of the Forestry Department.

**Habitat** : Dense deciduous dipterocarp forest covers the area of the park. Big trees include *Ficus carica*, *Dipterocarpus* spp., *Eugenia cumini*, *Erythrina* spp., *Hydnocarpus* spp., *Careya* spp., and wild rose apple. There is a pond about 0.5 ha in size where the monkeys were seen swimming and diving.

**Monkeys** : I counted 158 monkeys in this park in July, 1989, and 225 monkeys in January, 1991. The habitat provides ample natural foods such as fruits of *Ficus carica*, *Hydnocarpus* spp. for the monkeys. Even so, the park workers provide rice or bananas every day to the monkeys. Visitors to the park feed the monkeys with peanuts, bananas, and sweetmeats. The monkeys here are healthy but have an orangish pelage compared with other *M. fascicularis* in the region (Figure 14).

**Other wild animals** : Water monitor lizards (*Varanus salvator*).

#### **Wat Koo Pra Kona, Roi Et Province**

**Site** : Wat Koo Pra Kona (123 m msl; ca. 24 ha) is a Buddhist temple dating from 1912 in Tambon Sa Ku, Amphoe Suwannaphum. There were 15 monks in this temple. There is a pagoda now under the Fine Arts Dept., which dates back more than 1,400 years. During the dry season the temple receives about 300 visitors per day.

**Habitat** : The temple ground includes a small patch of dipterocarp forest (Figure 9). Behind the temple is a lake which is frequented by migratory wild ducks.

**Monkeys** : A monk reported 130 *M. fascicularis* here; I counted 66 individuals in July, 1989 and 121 in January, 1991. The monkeys and the forest were protected by the temple authorities. The monkeys were fed by the monks and merit-makers with rice, bananas, mangoes, peanuts, and some sweetmeats. They also foraged in the forest for natural foods such as dipterocarp and tamarind fruits. Their range was about 42 ha which included the temple ground and the surrounding forest. The monkeys appeared normal though some high-ranking ones appeared obese.

**Other wild animals** : Migratory wild ducks were reported.

#### **Don Poo Tao, Yasothon Province**

**Site** : Don Poo Tao (126 m msl) is a 9-ha mound in Ban Tao Hai, Tambon Sri Than, Amphoe Pa Tiew. There is a small shrine within this mound which is highly venerated. The mound is under the care of the village authorities.

**Habitat** : This mound is forested with some dipterocarp trees and vines.

**Monkeys** : There were 42 *M. fascicularis* here. Both the habitat and monkeys were undisturbed as humans showed respect and fear towards the shrine. The monkeys fed mostly on forest products and occasionally raided the rice fields. They were also at times provisioned by visitors with watermelon and bananas. On Buddhist religious days the monkeys were fed glutinous rice by the chief monk, Luang Pho Phra Athikarn, and some other monks from a nearby temple, Wat Tao Hai.

#### **Prang Koo, Yasothon Province**

**Site** : Prang Koo (123 m msl; 2.5 ha) is a ruin of an old pagoda in Ban Koo Jarn, Amphoe Khamkhernkaew.

**Habitat** : A small patch of undisturbed dipterocarp forest covers this mound which is under the care of the village authorities.

**Monkeys** : The villagers reported that there were about 70–80 *M. fascicularis* in this forest, but I counted only 12. The forest and monkeys received protection from the villagers. The monkeys spent most of their time in the forest and came out when called by the villagers at feeding time once in the morning and once in the evening to receive rice, bananas, water melons, guavas, and sweetmeats.

#### **Ban Wan, Si Saket Province**

**Site** : Ban Wan (126 m msl) is a small village located in Tambon Muang Kan in Amphoe Rasi Salai. This village is approximately 200 years old. An area of 4.5 ha includes a small public park and a primary school.



Figure 7. Habitat of *M. assamensis* at Wat Tham Pla, Chiang Rai Province (north Thailand).



Figure 8. Habitat of *M. mulatta* at Kumpawapi Park, Udon Thani Province (northeast Thailand).



Figure 9. Habitat of *M. fascicularis* at Wat Koo Pra Kona, Roi Et Province (northeast Thailand).

**Habitat** : The vegetation in this park is deciduous dipterocarp forest. The park is surrounded by the primary school, villages and rice fields.

**Monkeys** : There were about 100 *M. fascicularis* here. They supplemented their diet by feeding on young leaves, dipterocarp fruits, and leaves and fruits of wild mangoes in the forest. They raided nearby rice fields during the dry season, and stole young leaves and fruits of custard apple and mangoes, sweetmeats and chicken eggs from the villages. I was told that the town municipality provided funds to the village headman to feed the monkeys, but only a small amount of uncooked rice was given to them during my stay there. Generally, the monkeys appeared undernourished and many of them had bald patches of skin. The oldest report of the monkeys' presence here was over 70 years ago.

The villagers were not happy with the monkeys' presence and would prefer to be rid of them. However, neither the monkeys nor their habitat was disturbed because of the villagers' fear of spirits. There was a spirit house located in the monkeys' habitat and it was believed that ill-luck would befall those who would kill the monkeys or cut the trees. There was a report that some townfolk did capture some monkeys for food, and I was informed that there was a restaurant in Khon Kaen Province that paid Baht 400 to 500 per monkey.

#### **Wat Ban Kan Yai, Si Saket Province**

**Site** : Wat Ban Kan Yai (123 m msl), also known as Wat Ban Muang Khan, is a small Buddhist temple in Amphoe Rasi Salai covering an area of about 1 ha.

**Habitat** : Adjoining the temple is a deciduous dipterocarp forest covering an area of 23 ha.

**Monkeys** : I saw 15 *M. fascicularis*, but there were reported to have been more than 100 in late 1988. These were either captured or killed for food. The monkeys live in the forest

and subsist on forest products such as leaves and fruits of *Dipterocarpus* spp. but they visit the temple every morning for left-over food such as glutinous rice from the monks. Overall, the monkeys looked healthy.

## CENTRAL PLAINS

### **Wat Khao Noh, Nakhon Sawan Province**

**Site** : Wat Khao Noh (100 m msl) is located at the foot of Khao Noh (282 m msl; 68 ha) in Amphoe Banphod Phisai. There are some buildings which belong to the temple on the hill. There is a limestone quarry at the other end of Khao Noh which causes damage to the temple buildings.

**Habitat** : Scrub forest covers most of the hill, which is under the Forestry Department. There are some big trees such as tamarind, rain tree, etc. on the hill and in the temple grounds.

**Monkeys** : There were 179 *M. fascicularis* on the hill in February, 1991. These monkeys were protected by the monks, but some of them were killed while traveling outside the temple.

**Captive animals** : There was a captive common palm civet donated by a villager.

### **Wat Krieng Krai Klang, Nakhon Sawan Province**

**Site** : Wat Krieng Krai Klang (26 m msl) is located near the Nakhon Sawan River in Tambon Krieng Krai, Amphoe Muang Nakhon Sawan. The temple was founded in the Ayudhaya era about 400 years ago.

**Habitat** : This temple is surrounded by rice-fields and villages. There are a number of big trees such as tamarind, fig, etc.

**Monkeys** : I counted 195 *M. fascicularis* in this temple. These monkeys were fed by visitors with bananas, peanuts, etc. The monkeys were protected by the monks at the temple but some of them were killed when traveling out of the temple ground.

**Captive animals** : There were no captive animals in this temple, but there is a crocodile farm located nearby. The captive animals held there included two Asiatic jackals, three lesser mouse deer and a javan mongoose.

### **Wat Khao Sompoad, Lopburi Province**

**Site** : Wat Khao Sompoad (200 m msl ; 32 ha) is located at the foot of Khao Sompoad (695 m msl; ca. 10 km<sup>2</sup>) in Amphoe Chai Badan. This temple covers an area of 32 ha, excluding the mountain. The temple was founded in 1982. There are 30 monks, 13 novices, 120 nuns, and 60 other people in this temple.

**Habitat** : The forested limestone mountain covers an area of more than 10 km<sup>2</sup>.

**Monkeys** : About 125 *M. fascicularis* have been present on the hill for at least 20 years. These monkeys were provisioned by monks and nuns with left-over rice, seasonal fruits, etc. The monkeys were protected by monks and nuns, and seldom came down to raid crops due to shooting by villagers. The people in this temple, however, used sticks and stones to chase the monkeys away from their houses. Overall, these monkeys looked healthy.

**Other wild animals** : Other wild animals reported on the hill were serow, Asiatic black bear, Malayan sun bear, common barking deer, fishing cat, and civets. The survival of bears in this area, however, appears doubtful.

### **Sarn Pra Karn, Lopburi Province**

**Site** : Sarn Pra Karn (10 m msl, 0.3 ha) is a Buddhist shrine in Amphoe Muang Lopburi. This shrine is a major landmark and tourist attraction in the town, and Buddhists often visit it for merit-making.

Sarn Pra Karn, though under the care of Fine Arts Department, is maintained by the private sector which earns revenue from visitors and street vendors and provisions the monkeys. For this purpose, the care of the shrine is auctioned to the highest bidder on a yearly basis.

**Habitat** : The shrine ground has only a few large trees such as *Pithecolobium dulce*.

**Monkeys** : There were about 104 monkeys in and about the shrine. The monkeys' provisioned food consisted of peanuts, bananas, pods of *Pithecolobium dulce*, seeds of lotus, water melons, seasonal fruits such as rambutans, durians, rose apples, and vegetables such as lettuce, Chinese cabbages, cauliflowers and Chinese kale, pods of cow peas, fruits of musk melons and pumpkins, cucumbers, etc. Natural food included young leaves, flowers and pods of *Pithecolobium dulce*. Sometimes they stole food from vendors and visitors. A hotel owner in Lopburi gives the monkeys a party once a year, setting out tables with table cloths, place-settings and plates full of food. The monkeys create a tremendous mess out of the banquet, much to the entertainment of hundreds of local people and visitors. The banquet consists mainly of fruits, sweetmeats and soft drinks. The monkeys here were a nuisance, and they often attacked visitors. Most of the monkeys were obese and had bald patches of skin. There were also many individuals with broken bones and injuries. They often ranged beyond the shrine into the town. Though provisioned, the monkeys did not receive full protection. Infants were sometimes taken away to be kept as pets.

**Captive animals** : There were eight *M. fascicularis*, one *M. mulatta*, and one *M. nemestrina* in cages at the shrine.

### **Wat Khao Wong Kot, Lopburi Province**

**Site** : A brief visit was made to Wat Khao Wong Kot (20 m msl) located at the foot of Khao Wong Kot (159 m msl; 40 ha) in Amphoe Ban Mi. Though the temple was in the care of the Department of Religious Affairs, the hill was leased out to a private concern for quarrying.

**Habitat** : The scrub forest on the limestone hill covers an area of 40 ha.

**Monkeys** : I did not see the monkeys since they restrict themselves to the hill and rarely venture down. There was a report that some monkeys' infants were taken by a black-crowned night heron, which seems unlikely.

**Other wild animals** : Black-crowned night herons were reported.

### **Wat Phra Buddha Chai, Saraburi Province**

**Site** : Wat Phra Buddha Chai (60 m msl) is located at the foot of Khao Phra Buddha Chai (240 m msl; 60 ha) in Amphoe Muang. The hill is under the Forestry Department. The

temple was founded at least 300 years ago. There is a likeness of the Buddha formed by dripping water on a rock, which is highly venerated. There are many buildings and a large Buddha image on the hill, which belong to the temple. There were 30 monks, 15 novices, but no nuns in this temple in January, 1991.

**Habitat** : Dense secondary deciduous forest covers most of the hill.

**Monkeys** : At least 42 *M. fascicularis* were fed by a monk, Phra Auan, every morning with bananas, seasonal fruits, vegetables, left-over rice, etc. Other foods eaten included jackfruit, leaves of figs and leaves and fruits of mango. It is believed that the monkeys have been present on the hill for more than 200 years. They were protected by the monks; however, some of them were caught while traveling outside temple ground.

**Captive animals** : A crocodile farm is located near this temple. There are number of captive wildlife species such as : a pair of tigers, an Asian golden cat, six Asiatic black bears, six sambar deer, five Eld's deer, a pair of white-handed gibbons, a pair of pig-tailed macaques, a pair of pythons, a pair of purple swamphen and four osprey.

#### **Wat Pa Laelai, Suphanburi Province**

**Site** : Although I was informed by the head monk of Suphanburi Province that there were monkeys in this temple, I found no free-ranging monkeys there. The monkeys had been extirpated many years ago because of habitat loss. However, there were two separately caged monkeys, an adult male *M. fascicularis* and the other an adult male *M. nemestrina*, given to the temple by a person to earn religious merit.

#### **Wat Noi Chompoo, Suphanburi Province**

**Site** : Wat Noi Chompoo (5 m msl) is in Amphoe Si Prachan. A monk reported seeing only three *M. fascicularis*, as the rest were killed for food by the villagers living nearby. The villagers, however, claimed that the monkeys were a nuisance and raided their farms. I did not observe any monkeys in this temple since they were very shy.

#### **Wat Tham Sala, Nakhon Pathom Province**

**Site** : Wat Tham Sala (3 m msl) is a Buddhist monastery located in Tambon Tham Sala, Amphoe Muang Nakhon Pathom, covering an area of 3.2 ha. There were 42 monks and six novices at this temple in 1991.

**Habitat** : The temple ground has only a few large trees such as tamarinds, fragrant bakulas and bark-paper trees. There are some *Pithecolobium dulce* trees. There is a canal full of water hyacinths near the temple.

**Monkeys** : In May, 1989, there were 64 *Macaca fascicularis*, two *M. nemestrina*, and one *M. arctoides*. The *M. nemestrina* and the *M. arctoides* were donated to the temple by merit makers. The *M. nemestrina* intermingled freely with the *M. fascicularis*, but the *M. arctoides* was chained to a tree due to its aggressive nature. The monkeys received provisioning (rice and fruits) regularly from monks and occasionally from merit makers. The monkeys also fed on natural food such as young leaves and pods of tamarind, young leaves, flowers and fruits of *Streblus asper*, young leaves, flowers and pods of *Pithecolobium dulce*, and ripe bakula fruits. The monkeys spent most of the afternoon near the canal and fed on stalks of water hyacinth. A tour agency stopped bringing foreign tourists to the temple

about six years ago after a tourist was badly bitten. The monkeys were protected at the temple, but were sometimes accidentally killed by vehicles while crossing the road close to the temple. There was a carcass of an adult female *M. fascicularis* within the temple compound, but the cause of death was uncertain. An adult female groomed the carcass for about 50 seconds.

In December, 1990, I observed 67 *M. fascicularis* in the temple ground. These monkeys sometimes traveled out of the temple ground to the public health station and crossed the bridge to forage on in a rubbish dump nearby. The monkeys ranged over about 5 ha.

**Captive animals** : In December, 1990, I observed one *M. arctoides*, one *M. mulatta*, and one *M. nemestrina* in separate cages in this temple.

### **Wat Khao Khan Hok, Kanchanaburi Province**

**Site** : Wat Khao Khan Hok (80 m msl ; 2.7 ha) is located at the foot of the hill "Khao Khan Hok" (147 m msl; 57.5 ha) in Amphoe Tha Muang. The hill is under the Forestry Department.

**Habitat** : Dense forest covers the limestone hill.

**Monkeys** : About 200 *M. fascicularis* have been reported; however, I observed only 30 individuals in December, 1990. The monkeys came down from the hill to feed on left-over rice, bananas, etc. in the dry season. The monks did not feed the monkeys in the rainy season because there was enough natural food in the forest. The natural foods included bamboo shoots; leaves and flowers of *Schrebera swietenoides*, hog plum, papaya, bananas, figs and *Diospyros mollis*. The monkeys sometimes came down to raid sugar cane fields around the hill. Overall these monkeys looked healthy.

The abbot regretted his action when he dyed a monkey to make it beautiful, as later it was killed by other adult monkeys.

**Other wild animals** : Pythons and cobras were reported on the hill.

**Captive animals** : Three adult monkeys were caged due to their aggressive nature. One was a hybrid between a male *M. fascicularis* and a female *M. nemestrina*. The hybrid had a face similar to its mother but had a longer tail. The second monkey was a female *M. nemestrina*, and the last was an adult male *M. mulatta*. These monkeys were given by local villagers.

### **Wat Tham Kunchorn, Ratchaburi Province**

**Site** : Wat Tham Kunchorn or Elephant Cave Temple (138 m msl) is in Tambon Huai Pai, Amphoe Muang Ratchaburi. There are several quarries at Khao Sam Ngam, about 800 m southeast of the temple, which cause air and noise pollution.

**Habitat** : The forested limestone hill covers an area of 12 ha.

**Monkeys** : About 20 *M. fascicularis* were reported but only nine were observed. The monkeys are protected by the monks and nuns because of Princess Sirinthorn's order. The temple-keeper have to use fire-crackers and sticks to chase away the monkeys when they try to enter monks' houses. There was a report that a troop of macaques migrated about 1 km from Khao Sam Ngam to Khao Tham Kunchorn due to the quarrying in 1987.

These monkeys were provisioned by the monks with left-over rice and fruits such



as bananas, rose apples, etc. Their natural foods include fruits and leaves of hog plum, bark-paper tree, figs, fragrant bakulas, papaya, etc.

**Other wild animals** : Civets and water monitor lizards are reported.

#### **Wat Khao Yod Thong, Ratchaburi Province**

**Site** : Wat Khao Yod Thong (80 m msl) is located at the foot of Khao Yod Thong (180 m msl; 27 ha) in Amphoe Pak Tho. Khao Yod Thong is located near Khao Sam Ngam, but within a different amphoe (district). The hill is under the Forestry Department. The abbot had protected the hill from a quarrying company which wanted to mine limestone.

**Habitat** : Secondary forest and bamboo are dominant on the hill.

**Monkeys** : About 20 *M. fascicularis* were present in this temple. These monkeys seldom come down to the temple because the temple dogs chase them.

#### **Tham Chomphon, Ratchaburi Province**

**Site** : Tham Chomphon or "General Cave" was named by King Rama V's queen in 1885 because of its beauty. Many tourists come to the cave, especially on weekends or holidays. The cave is in Khao Tham Chomphon (191 m msl; 15 ha) in Amphoe Chom Beung. The cave is under the care of Wat Chom Beung. There were 38 monks and 13 novices in Wat Chom Beung in December, 1990.

**Habitat** : The forest on the limestone hill is under the care of the Forestry Department. There is a road encircling the hill. There is a college, some houses, government offices and a public park surrounding the hill.

**Monkeys** : About 200 *M. fascicularis* were fed with left-over rice, bananas, peanuts, etc. by visitors and monks. There was no real threat to the monkeys but hawkers used sticks to chase the monkeys away from their stalls. These monkeys were studied in 1988 (KAWAMOTO *et al.*, 1989; SUZUKI & VARAVUDHI, 1989; TAKENAKA *et al.*, 1989; VARAVUDHI *et al.*, 1989a; b; 1992).

#### **Wat Khao Chong Phran, Ratchaburi Province**

**Site** : Wat Khao Chong Phran (10 msl) is located at the foot of the hill, Khao Chong Phran (40 m msl; 11 ha) in Amphoe Photharam. The hill is under the Forestry Department. The temple is a Burmese-Buddhist temple among Mon villages.

**Habitat** : Secondary forest covers most of the hill.

**Monkeys** : About 20 *M. fascicularis* were observed at this temple in December, 1990. The monkeys came down from the hill to feed on bananas, left-over rice, water, etc. These monkeys have been reported to have been present on the hill for at least 80 years.

**Other wild animals** : There are number of bats in the caves. Guano is collected for fertilizer.

#### **Wat Khao Khang, Ratchaburi Province**

**Site** : Wat Khao Khang (10 m msl) is located north of Khao Khang (141 m msl) in Amphoe Muang Ratchaburi. The temple covers an area of four ha excluding the hill. The 57-ha hill is under the Forestry Department.

**Habitat** : Dense forest covers this limestone hill.

**Monkeys** : About 20 *M. fascicularis* were reported on this hill, but I did not manage to see any. The monkeys reportedly come down from the hill to feed on rice and seasonal fruits. Natural foods included tamarind, rain tree, bamboo shoots, etc.

### **Wat Ngern Rung Sawang, Ratchaburi Province**

**Site** : Wat Ngern Rung Sawang (10 m msl) or Wat Tham Nam (water cave) is located on another side of Khao Khang. This temple was founded in 1972. There are numbers of patients under the care of the abbot who is a herbal medicine practitioner.

**Habitat** : Dense forest covers the hill behind the temple.

**Monkeys** : About 26 *M. fascicularis* were observed at this temple. These monkeys may be of the same group as in Wat Khao Khang. The monkeys came down from the hill to feed on left-over rice, bananas, etc.

**Captive animals** : There was a caged adult female and a chained infant male *M. fascicularis*, three caged *M. nemestrina* (an adult male, a subadult male and a subadult female), a chained adult female white-handed gibbon and a pair of caged common palm civets.

There were many caged birds such as Indian pied hornbill, green peafowl, silver pheasant, white-breasted waterhen, blue magpie and turkeys in this temple. The abbot kept these captive animals to attract more merit-makers but later complained about the rearing expenses.

### **Wat Huai Takhaeng, Ratchaburi Province**

**Site** : Wat Huai Takhaeng (10 m msl) is at the foot of Khao Takhaeng (60 m msl) in Amphoe Muang. The temple covers an area of 1 ha, excluding the hill.

**Habitat** : The forested limestone hill covers an area of 5 ha.

**monkeys** : There were at least 28 *M. fascicularis* in this temple in December, 1990. They were provisioned by the monks and visitors with left-over rice, vegetables, etc. A group of vegetable sellers often give left-overs such as cucumbers and egg-plants (*Solanum* spp.) to the monkeys. The monkeys sometimes search for pigeon's eggs under the roofs. Natural foods include fruits and leaves of figs, *Streblus asper*, hog plum and mango.

The abbot informed me that these monkeys were poisoned by some villagers but the monkeys recovered by eating leaves of various forest trees. Overall the monkeys looked healthy.

About 50 monkeys from this temple were caught and released at Sai Yok Temple in Kanchanaburi in 1990.

### **Khao Suan Luang Ratchaburi Province**

**Site** : Khao Suan Luang (80 m msl; 25 ha) is located in Amphoe Muang. There is a nun's monastery, Arsom Sathan, located east of Khao Suan Luang, where about 55 nuns lived. A monk's monastery is located west of the hill. The Arsom Sathan covers an area of 11.2 ha, excluding the hill.

**Habitat** : Secondary forest and bamboo are dominant on the hill.

**Monkeys** : About 64 *M. fascicularis* were observed on this hill in December, 1990, said to have been present at least 40 years. A nun informed me that the monkeys were very

aggressive during the rainy season, when she observed the monkeys mating. Nuns therefore had to use sticks to chase away the monkeys and had to bar their houses. The nun once saw some monkeys killed for food by a group of outsiders.

These monkeys came down from the hill to feed on provisioned food such as left-over rice, fruit, vegetables, etc. They also fed on natural foods such as shoots and leaves of bamboo, shoots of lemon grass, flowers of *Ixora coccinea*, leaves of *Dalbergia volubilis*, *Diospyros rhodocalyx*, *Millingtonia hortensis*, *Sesbania grandiflora*, ripe jackfruits, fruits of neme tree in the dry season, and tamarind pods in winter.

### **Wat Ratch Singkhorn, Ratchaburi Province**

**Site** : Wat Ratch Singkhorn (6 m msl; ca. 8 ha) is located at the foot of Khao Ngu (239 m msl; 125 ha) in Amphoe Muang Ratchaburi. There are seven monks and three nuns in this temple.

**Habitat** : There were several quarries on the limestone hill which caused air pollution around Khao Ngu. Some of the quarrying work was moved to Khao Sam Ngam few years ago due to protests by villagers.

**Monkeys** : About 142 *M. fascicularis* were in this temple in December, 1990. The monkeys had been present on the hill for at least 25 years. They were provisioned by monks, nuns and visitors with left-over rice, bananas, peanuts, and fish-food. Hawkers sold food for them in the temple ground. The monkeys were a tourist attraction.

There were no real threats to these monkeys. The abbot was supposed to build a huge cage for keeping the monkeys because they were becoming a nuisance. Princess Sirinthorn had discouraged people from killing or disturbing the monkeys. The monks provided water to them in the dry season. Overall, they looked healthy.

**Captive animals** : There were some chained animals : an adult male *M. nemestrina*, an adult male *M. arctoides*, and an adult female white-handed gibbon.

## **SOUTHEAST THAILAND**

### **Khao Sam Muk, Chonburi Province**

**Site** : Khao Sam Muk (75 m msl; 125 ha) is a rocky hill located east of the Gulf of Thailand in Amphoe Muang Chonburi. Khao Sam Muk is near Bang Saen Beach and is visited by both local and foreign tourists. There are two shrines, the first a small Thai shrine located west of Sam Muk cape, the other a big Chinese shrine located east of the cape.

**Habitat** : Secondary forest covers the hill.

**Monkeys** : I counted 126 *M. fascicularis* in two groups at Khao Sam Muk in November, 1990. The ratio of known adult males to adult females was 1 : 2.4. In early 1980, K. MEESWAT (1981) who studied the dominance relations of the groups, estimated the whole population of three subgroups to be about 100-150. These monkeys are a tourist attraction (Figure 10). There are two *M. nemestrina*, one *M. mulatta* and one *M. arctoides* in the colony. There are three food stalls selling monkey food such as bananas, tomatoes, pineapple, oranges, a variety of pickled fruits, corn, lotus seed, yam bean, pods of pigeon peas and *Pithecolobium dulce*, boiled quails' eggs, etc. The monkeys are protected by the stall-keepers because they venerate the Chao Mae Sam Muk. About 300 years ago a

woman by the name of Sam Muk killed herself there. When she was alive, she used to play with the monkeys. It is believed that ill-luck will befall those who kill the monkeys (CHAWALSILP, 1981; MEESWAT, 1981).

The monkeys often come down to a stony beach at the cape to feed on small crabs and rubbish (CHAWALSILP, 1981; MEESWAT, 1981). They traveled all over the hill (125 ha) but tended to spend time near these two shrines because of the provisioning. A shrine-keeper informed me that some of the monkeys drowned when they went swimming. I observed a juvenile monkey saved by the shrine-keeper from drowning, but later the monkey was killed by adult monkeys.

### **Ko Si Chang, Chonburi Province**

**Site** : Ko Si Chang (193 m msl) is an island about 5 km offshore from Si Racha town in the Gulf of Thailand. The island covers an area of about 7 km<sup>2</sup> which includes King Rama V's palace, a Chinese shrine, two Buddhist temples, a Marine Research Station of Chulalongkorn University, and a few villages.

**Habitat** : Scrub forest and grassland covers most of this limestone island.

**Monkeys** : Although I did not observe any monkeys, I was informed by villagers that long-tailed macaques sometimes come down from the forested hill at the north end of the island to feed on tamarind, papaya and to raid crops and enter houses to steal food items.

**Other wild animals** : White squirrels (*Callosciurus finlaysoni*) live in the forest on the island.

### **Ko Khangkhao, Chonburi Province**

**Site** : Ko Khangkhao or Bat Island (35 ha; 90 m msl), so named because of its shape, is located about 1 km south of Ko Si Chang.

**Habitat** : Scrub forest covers most of the island.

**Monkeys** : A boat-man informed me that there was a small group of long-tailed macaques on this island.

**Other animals** : Goats are now raised on the island.

## **UPPER PENINSULA**

### **Khao Wang, Phetburi Province**

**Site** : Khao Wang (80 m msl) is a limestone hill at the edge of the city of Phetburi, covering an area of about 23 ha. Khao Wang is a major tourist attraction in Phetburi Province, drawing several hundred tourists on weekends and several thousand on festive days. On top of the hill is King Mongkut's Phra Nakhon Khiri Palace dating back to 1869. Wat Maha Samanaram, a Buddhist temple, is located close to the base of the hill. Khao Wang comes under the care of the Department of Fine Arts.

**Habitat** : Dense scrub forest covers most of the hill. There are many big trees such as tamarind, figs, bamboo, coral trees (*Erythrina* spp.), etc (Figure 11).

**Monkeys** : There were 73 *M. fascicularis* at this site in August, 1989, and about 120 monkeys in February, 1991. The monkeys spent most of their time under the trees near the entrance. The monkeys, however, were reported travel all over the hill, ranging about 33 ha. The monkeys are a source of amusement and attraction to the visitors, but are also

sometimes a nuisance. Some have been injured by humans. The monkeys are provisioned by visitors most of the day, making them obese. Provisioning of the monkeys has increased the number of vendors selling monkey foods like bananas, maize, coconut, and peanuts. Leftovers from the temple are also given to the monkeys. The monkeys are protected by Princess Sirinthorn's order after she saw that some of them had been injured by humans.

#### **Wat Bun Thawi, Phetburi Province**

**Site** : Wat Bun Thawi (5 m msl) is located at the lower portion of Khao Luang (74 m msl; 60 ha) in Amphoe Muang. Khao Luang is a major tourist attraction in Phetburi Province, famous for its caves and underground Buddhist shrine.

**Habitat** : Khao Luang has scrub forest covering limestone hills, a common topographical feature of Phetburi Province.

**Monkeys** : The monkeys found here are *M. fascicularis*, and there were about 50 in August, 1989, but only 35 were counted in February, 1991. According to information received, the monkeys until 1984 used to restrict themselves to the forested part of the hill. However, this changed after tourists started provisioning the monkeys. This provisioning gave rise to numerous vendors selling food such as bananas, coconuts, and peanuts. Besides food received from provisioning, the monkeys supplement their diet with young leaves of bel fruits, pods of flame tree and insects.

#### **Wat Kut, Phetburi Province**

**Site** : Wat Kut (1 m msl ; 4.3 ha), also called Wat Kugi, is a Buddhist temple located in a small village of Amphoe Ban Laem District.

**Habitat** : There is a small patch of deciduous dipterocarp forest in the temple ground.

**Monkeys** : There were 35 *M. fascicularis* observed in August, 1989. The monkeys spent most of their time in the forest and came out on Wednesdays and Saturdays when a fresh food market was set up at the temple. On these days the monkeys steal or receive foods such as rice, bananas, vegetables and chicken eggs from the customers and vendors. Their natural foods include figs, leaves and fruits of *Coccinia grandis* and leaves and fruits of *Diospyros rhodocalyx*. Overall, the monkeys looked healthy.

#### **Wat Khao Bandai It, Phetburi Province**

**Site** : Wat Khao Bandai It (30 m msl) is a Buddhist temple located on the southern part of Khao Bandai It (60 m msl) in Amphoe Muang, Phetburi. The forested limestone hill, Khao Bandai It, covers an area of 75 ha. Many tourists and merit makers come to this temple because of the underground Buddhist shrines. The hill is under the Forestry Department.

**Habitat** : Most of the hill is covered by scrub forest.

**Monkeys** : I found 35 *M. fascicularis* on this hill just behind the temple in August, 1989. The monkeys received leftover food from the monks, and sometimes stole from the kitchen. They spent most of their time in the forest. Some of their natural foods are young leaves and ripe fruits of *Ficus* spp., *Coccinia grandis* and ripe fruits of *Diospyros* sp. The

monkeys were considered to be a nuisance and did not receive any protection from the temple. They did not attract tourists. Many were killed as crop pests by the villagers nearby. The abbot used fire-crackers to chase the monkeys away from the temple. I found only five macaques on February 11, 1991. The monkeys looked healthy.

**Captive animals** : In August 1989, two wild boars, one white-handed gibbon, one leopard cat, and two pairs of lesser whistling-ducks were given to the temple by merit-makers but the two boars died within a year.

**Other wild animals** : On the hill I came across fresh scats and pugmarks of a fishing cat. Local farmers also reported seeing the cat.

### **Wat Ban Rai Don, Phetburi Province**

**Site** : Wat Ban Rai Don (40 m msl) is another Buddhist temple located at the foot of Khao Bandai It in Amphoe Muang Phetburi. The hill is under the Forestry Department.

**Habitat** : Scrub forest and *Euphorbia* spp. covers this part of the hill.

**Monkeys** : A nun reported that there were 20-30 *M. fascicularis* that occasionally came down to the temple; however, I did not observe any.

### **Wat Khao Takhrao, Phetburi Province**

**Site** : Wat Khao Takhrao ( 1 m msl; 12.5 ha) is a Buddhist temple in Amphoe Ban Laem. The temple covers an area of 12.5 ha which includes a primary school and a small hill, Khao Takhrao (59 m msl; 7 ha). There were 169 monks, 72 nuns, and 78 novices at this temple in August, 1989.

**Habitat** : This temple has mangrove forest on one side and shrimp farms on three other sides.

**Monkeys** : There was a small group of about 10 *M. fascicularis* on this hill in August, 1989, and about 17 monkeys were seen in February, 1991. A monk, Phra Chuen Khemrangi, had seen the monkeys since 1952. The monkeys are fed by the nuns with fruits such as bananas, rambutans and left-over rice; they sometimes steal sweetened condensed milk. They were also observed eating crabs, young nipa fruits and flowers and pods of *Rhizophora* spp. The monkeys are protected by the temple, but there was a report that a villager had killed a few monkeys after his daughter had been bitten by one. Overall the monkeys looked healthy.

### **Wat Khao Tamon, Phetburi Province**

**Site** : Wat Khao Tamon (10 m msl) is located at the foot of Khao Tamon (60 m msl), a limestone hill of 10 ha in Ban Lard District. This temple covers an area of 3.7 ha. There were 14 monks, two novices, three nuns, and seven temple boys. This temple was founded in the era of King Rama I, and was renovated in 1965.

**Habitat** : Scrub forest covers this hill. There are some big trees such as tamarind, rain tree, etc.

**Monkeys** : *Macaca fascicularis* have been present on the hill for more than 100 years. Over 100 of these macaques come down every day to feed on provisioned food such as left-over rice mixed with curry, fruit, etc. Natural foods which the monkeys feed on

included young leaves of *Streblus asper*, *Diospyros rhodocalyx*, *Arfeuillea arborescens*, flowers of jasmine, leaves and pods of rain tree, etc.

Some of these macaques were shot by villagers and policemen about 10 years ago. It is believed that bad luck will befall anybody who kills the monkeys. The monks have to use sticks to chase the monkeys away from their houses.

It was reported that the monkeys traveled to another hill, Khao Cha Ngae, about 5 km away from Khao Tamon to raid a maize field.

**Other wild animals** : I saw a water monitor lizard (*Varanus salvator*) climbing up a tree. Civets are also present.

### **Wat Khao Tao Mo, Phetburi Province**

**Site** : Wat Khao Tao Mo (100 m msl) is located at the foot of Khao Tao Mo (240 m msl, 75 ha) in Amphoe Tha Yang. This hill has a series of large caves, some of which are used by monks and novices for meditation. Thai tourists also visit there. There were four monks, four nuns and four novices at the temple in February, 1991. There is a pond east of the hill which is dry in the dry season (Figure 12).

**Habitat** : Limestone forest, bamboo, grasses and *Balanostreblus ilicifolia* covers most of the hill (Figure 13).

**Monkeys** : A small troop of 31 *Macaca arctoides* was observed in February, 1991. These had been reported by U. TREESUCON (1988). They ranged all over the hill and came down to the temple ground, covering an area of at least 55 ha. They also spent some time at a pond east of the hill. The monkeys did not rely too much on provisioning except during the dry season when they were offered bananas, papayas and left-over food. Otherwise, there was ample natural food on the hill including tamarind, figs (*Ficus carica*); *Diospyros mollis*, and fruits and young leaves of *Balanostreblus ilicifolia*. The monkeys came down from the hill when called by a monk who fed them left-over porridge nearly every day. Occasionally, the monkeys raid nearby field crops such as maize, sorghum, tapioca and sweet potato. The monkeys looked healthy.

**Other wild animals** : I saw a pile of serow feces at one of the monkeys' sleeping sites on the hill.

### **Wat<sup>1</sup>, Phetburi Province**

**Site** : This temple covers an area of 9.6 ha. The temple, which has three monks and three nuns, was founded about 20 years ago.

**Habitat** : Dense forest, scrubby in places, covers most of the hill.

**Monkeys** : About 10 *M. arctoides* are reported to be on the hill. These monkeys come down from the hill to feed on papaya, banana and maize. The monkeys are protected by the monks but two monkeys were killed when they traveled out of temple ground and raided crops. It is believed that bad luck will befall anybody who kills the monkeys.

**Other wild animals** : Wild boars are also reported on the hill.

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<sup>1</sup> Name and location withheld by request.

### **Wat Cha-Am Kiri, Phetburi Province**

**Site** : Wat Cha-Am Kiri (1 m msl) is located at the foot of a limestone hill, Khao Cha-Am (60 m msl; 3 ha), in Amphoe Cha-Am. The temple is a major tourist attraction famous for its archaeology.

**Habitat** : Secondary forest covers the small limestone hill.

**Monkeys** : The abbot and villagers informed me that there existed a troop of long-tailed macaques which disappeared almost 10 years ago due to hunting for food by the nearby villagers. The abbot reported that the remaining monkeys moved to Khao Chaolai located 3 km southwest.

**Other wild animals** : The abbot reported that leaf monkeys have been present on the hill.

### **Wat Khao Takieb, Prachuabkirikhan Province**

**Site** : Wat Khao Takieb (10 m msl) is in Amphoe Hua Hin. The temple is located on a granite-gneiss stone hill, Khao Takieb (100 m msl; 25 ha). This temple is regularly visited by merit makers because the abbot is highly venerated, and also by foreign tourists due to its location near Hua Hin beach.

**Habitat** : Until about 1978, prior to the arrival of the abbot, the hill was covered only with grasses and shrubs. However, since then the hill has been planted with bamboo spp., *Ficus* spp., tamarind, etc. to prevent soil erosion.

**Monkeys** : The 84 *M. fascicularis* in this temple were observed in September, 1990. They are protected by the abbot, who is very concerned about conservation, and worries about diseases such as rabies. It is believed that the macaques could have been originally found here or they could have migrated from the Monkey Park at Hua Hin District some 40 years ago. The Monkey Park belonged to a Mr. Yuk Aswarak who traded long-tailed macaques to various zoos and research institutes in the U.S.

In 1984, about 70 of the macaques were shot and their brains were reportedly eaten raw by a group of men dressed in either police or army uniforms. The abbot reported the incident to the police and army but there was no response and since then the monkeys have been shy of humans.

The macaques were provisioned by the monks, nuns, and visitors. The abbot started selling monkey food such as bananas and peanuts about 10 years ago because there was not enough natural food for the monkeys. The monkeys sometimes searched for food such as crabs, clams and fishes at the rocky seashore by the temple. The natural foods included leaves and pods of tamarind; fruits of hog plum, *Manilkara hexandra*, *Momordica* spp., flowers and stems of *Euphorbia* spp. and bamboo shoots.

**Other wildlife** : Other wildlife found near this temple includes pythons and water monitor lizards.

### **Wat Thammikaram Varaviharn, Prachuabkirikhan Province**

**Site** : Wat Thammikaram Varaviharn (5 m msl) is located near Khao Chong Krajok (60 m msl; 16 ha) in Amphoe Muang. This temple was founded in 1964.

**Habitat** : This forested limestone hill is located beside a beach which is a tourist site.

**Monkeys** : At least 69 *M. fascicularis* lived on the hill in September, 1990. They came down to get provisioned food such as coconuts, bananas, peanuts, and cucumbers from





Figure 10. Tourists at Khao Sam Muk, Chonburi Province (southeast Thailand).



Figure 11. Habitat of *M. fascicularis* at Khao Wang, Phetburi Province (upper peninsula).



Figure 12. *M. arctoides* were foraging near a dried pond at Wat Khao Tao Mo, Phetburi Province (upper peninsula).



Figure 13. Habitat of *M. arctoides* at Wat Khao Tao Mo, Phetburi Province (upper peninsula).

visitors. The provisioned foods were sold by a number of hawkers around Khao Chong Krajok, which is also a tourist site. The town municipality provided water for the monkeys every day. Other foods which the monkeys fed on included leaves, flowers and pods of rain tree. The monkeys traveled to the beach on the eastern-side of the hill to catch crabs and clams. There was no real threat to these monkeys, though hawkers had to use sticks to chase the monkeys away from their stalls.

## LOWER PENINSULA

### Wat Tha Mai-Lai, Chumphon Province

**Site** : Wat Tha Mai-Lai (70 m msl; 3 ha) is located near Tha Mai-Lai School in Tha Mai-Lai village about 500 m off Phet Kasem road.

**Habitat** : Slash-and-burn agriculture was carried out about 1 km behind the temple. There remain 160 ha of rainforest near Tha Mai-Lai village which as a result of a blockade by villagers to prevent a logging company, Chumphon Kha Mai, from entering the area.

**Monkeys** : About nine years ago it was reported that there were 11 long-tailed macaques; however, only three remain now as the rest were killed by villagers who considered the monkeys as pests.

The monkeys were fed by the monks every morning with left-over rice, fruits such as rambutans, durians, bananas, etc. The monkeys also fed on young leaves and fruits of plants grown around the temple; for example, durians, jack fruits, papayas, rambutans and bamboo shoots.

**Other wildlife** : Other animals reported seen in this area are leopard, dusky langur and pangolin.

### Wat Tham Khao Phlu, Chumphon Province

**Site** : Wat Tham Khao Phlu (20 m msl) is located on the foot of the hill "Khao Phlu" (100 m msl) in Amphoe Pathiew.

**Habitat** : The forest on the limestone hill, covering an area of 72 ha, was abundant before it was damaged by the Typhoon Gay in 1989.

**Monkeys** : There were at least seven dusky langurs (*Trachypithecus obscurus*) when I visited this temple. These langurs were protected by a monk, Luang Pho Bua. Villagers believe that bad fortune will befall anyone who kills the langurs due to the spirit of a monk, Luang Pho Jeet, who died in 1895. Luang Pho Bua feeds bananas to the langurs every morning. The natural foods available include fruits of fig, young leaves of tamarind, *Spondias* spp., etc.

**Other wild animals** : The villagers reported the presence of long-tailed macaques, white-handed gibbons, Asiatic black bears, serow, common wild boar, common barking deer, pangolin and civets in this area.

### Wat Tham Suwan Khuha, Phangnga Province

**Site** : Wat Tham Suwan Khuha (10 m msl) is located by Khao Tham (100 m msl) at Tambon Krasom, Amphoe Takua Thung. The limestone hill covers an area of 17.5 ha. Khao Tham is a tourist attraction due to the presence of many caves. There are inscriptions of King Rama V and King Rama IX on the wall of one of the caves.

**Habitat** : Dense forest covers the hill.

**Monkeys** : The villagers informed me that there were about 20 long-tailed macaques on this hill but they rarely came down since some of them were killed by villagers for food. The monkeys, even though protected by the monks, may be killed if they travel out of the temple compound.

The monkeys were fed by villagers, monks, and local and foreign tourists with bananas, peanuts, left-over rice, etc.

**Other wildlife** : There are many bats in the caves at this temple, and the guano is collected by the students of Phangnga Agricultural School for fertilizer.

### **Wat Tham Sua, Krabi Province**

**Site** : Wat Tham Sua or “Tiger Cave Temple” is located in Amphoe Muang Krabi. There is a big golden statue of a Chinese goddess, Chao Mae Kuan Im, which brings donations from Malaysian and Singaporean Chinese. The local monk, Phra maha Jamnien, is well known as a teacher of insight meditation and loving kindness, Many young women come here to practice as “eight-precept” nuns.

**Habitat** : The temple covers an area of 32 ha which includes a limestone hill covered by tropical rainforest.

**Monkeys** : I counted 23 *M. fascicularis* in this temple. Five adult males in this colony were caught and released at Trang and Phatthalung Provinces because they had become a nuisance. There was no real threat to the monkeys, which were provisioned by some monks. However, Phra Maha Jamnien does not encourage provisioning of the monkeys because they sometimes bite children. One adult male is chained at the house of a monk. The monk said that the monkey was given by a villager.

**Other wild animals** : Other animals reported seen in this temple include white-handed gibbons, dusky langurs, civets, fishing cat, squirrels, flying squirrels, and birds such as blue whistling thrush, pittas, barn owl, and adjutant.

**Captive animals** : red junglefowl and mouse deer.

### **Wat Khuha Sawan, Phatthalung Province**

**Site** : Wat Khuha Sawan (20 m msl) is an old temple founded in 657 AD. The temple is located in Phatthalung town beside a limestone hill, Khao Tham Khuha Sawan or Khao Tham Khuha Sung (215 m msl; 55 ha). The temple covers an area of 8 ha which is under the care of Department of Religious Affairs. There were 41 monks, 47 novices, and 15 temple boys in February, 1991.

**Habitat** : Moist evergreen forest covers the hill.

**Monkeys** : There were 56 *M. fascicularis* counted in this temple in September, 1990, in two groups. One group consisted of about 44 monkeys which foraged around human habitations. The second group was very shy, living in the forest on the hill. I observed only 12 individuals in that group.

In February, 1991, I observed 51 macaques in the first group, but I could not observe any monkeys from the second group since they were very shy. The monks and villagers reported that the monkeys ranged over almost all of the hill and the temple ground, covering an area of 55 ha.

The 80-year old abbot is very interested in conservation. He informed me that eight monkeys were shot by poachers and their skins were peeled off so the bodies could be passed off as langurs, and later sold to the Trang Hotel for food.

These monkeys were fed by resident monks and visitors. The foods included left-over rice, peanuts, vegetables, bananas, seasonal fruits such as rambutans, sapodilla, etc. Wild foods consisted of young leaves and pods of tamarind, rain tree and fruits of fig, sapodilla, jackfruit, champadak, bilimbi, star fruit, schomburgk, bel fruit, *Sandoricum sp.*, leaves, stems and fruits of papaya, etc. Overall, these monkeys looked healthy. Other wild animals : Leopards, civets, pythons, water monitor lizards and squirrels.

### **Khao Noi/Khao Tang Kuan, Songkhla Province**

**Site** : Khao Noi (60 m msl; 13 ha) and Khao Tang Kuan (80 m msl; 20 ha) are two hills located close to one another near Samila beach in Amphoe Muang Songkhla. These hills are regularly visited as a side attraction to Samila beach, by both local people and tourists. The pagoda and sala vihar on Khao Tang Kuan dates back to 1888 during the reign of King Rama IV. A lighthouse and a small Buddhist monastery with three monks and two nuns is on Khao Tang Kuan. Khao Tang Kuan is under the care of the Fine Arts Department and Khao Noi is under the care of the town municipality.

**Habitat** : Moist evergreen forest covers Khao Noi and Khao Tang Kuan.

**Monkeys** : A large troop of *Macaca fascicularis* consisting of about 63 individuals was observed at the base of Khao Tang Kuan on the side facing Khao Noi in April, 1989. The monkeys were found here for most of the day because of provisioning by visitors. The provisioned foods included bananas, mangoes, guavas, rice, nuts (*Acacia auriculiformis*), crackers and other sweetmeats. A number of food stalls catered to the visitors. The monkeys sometimes snatched food from these stalls and the people eating there. A small group composed of an adult male and two adult female long-tailed macaques was found at the temple on Khao Tang Kuan. The abbot informed me that these monkeys split from the main troop after the adult male fought with the adult male of the main troop.

The monkeys at both locations were also fed on natural foods such as young leaves and pods of tamarind, young leaves and fruits of mangoes, chestnuts, fruits of *Zollingeria dongnaiensis*, *Lepisanthes rubiginosum*, *Grewia paniculata* and young leaves of mengudus (*Morinda* spp.). The monkeys were reported to have been present on these hills for at least 70 years. There was no real threat to these monkeys, except occasionally stones were thrown at them. Indeed some food stalls thrive because of the monkeys presence. Fifteen monkeys were caught to obtain somatic measurements and blood samples in 1988 (Kawamoto *et al.*, 1989; SUZUKI & VARAVUDHI, 1989; TAKENAKA *et al.*, 1989; VARAVUDHI *et al.* 1989a; b; 1992).

**Other wild animals** : Wild animals reported on these hills included civets, slow loris, tortoises, snakes, pangolin, and water monitor lizards. The chief monk reported seeing four sambar deer on Khao Tang Kuan about 20 years ago.

### **Wat Khuha Phimuk, Yala Province**

**Site** : Wat Khuha Phimuk (20 m msl) or Wat Na Tham is located beside a limestone hill, Khao Kampan (172 m msl; 50 ha), in Amphoe Muang Yala. This Buddhist temple is in

Table 4. Age-sex composition of macaques at 36 visited sites (sex ratio of adults is given in brackets). Data for second visits are in bold face.

No.	Location	Species	Total	A			J			I	RI
				M	F	U	M	F	U		
1.	Wat Tham Pla, Chiang Rai.	as	36	3	13	-	6	6	-	8	0.6
			<b>56</b>	<b>9</b>	<b>15</b>	-	<b>7</b>	<b>5</b>	-	<b>20</b>	<b>1.3</b>
2.	Kumpawapi Park, Udon Thani.	m	127	13	51	-	16	10	17	20	0.4
			<b>103</b>	<b>19</b>	<b>42</b>	-	<b>8</b>	<b>7</b>	<b>3</b>	<b>24</b>	<b>0.6</b>
3.	Kosumphi Forest- Park, Maha Sarakham.	f	158	10	63	-	21	9	3	52	0.8
			<b>235</b>	<b>53</b>	<b>108</b>	-	<b>32</b>	<b>21</b>	<b>2</b>	<b>19</b>	<b>0.2</b>
4.	Wat Koo Pra Kona, Roi Et.	f	66	9	26	1	10	1	2	17	0.6
			<b>121</b>	<b>17</b>	<b>38</b>	-	<b>22</b>	<b>9</b>	<b>3</b>	<b>32</b>	<b>0.8</b>
5.	Don Poo Tao, Yasothon.	f	42	4	14	-	9	-	5	10	0.7
6.	Prang Koo, Yasothon.	f	12	1	3	-	6	-	-	2	0.7
7.	Ban Wan, Si Saket.	f	100	12	48	-	10	2	-	28	0.6
8.	Wat Ban Kan Yai, Si Saket.	f	15	3	5	2	4	-	-	1	0.2
9.	Wat Khao Noh, Nakhon Sawan.	f	179	26	66	-	31	20	-	36	0.5
10.	Wat Krieng Krai Klang, Nakhon Sawan.	f	195	39	73	-	16	23	-	44	0.6
11.	Wat Khao Sompoad, Lopburi.	f	125	27	50	-	26	8	5	9	0.2
12.	Sarn Pra Karn, Lopburi.	f	104	7	48	-	13	5	-	31	0.6
13.	Wat Phra Buddha- Chai, Saraburi.	f	50	11	21	-	11	4	1	2	0.1

Table 4 (continued)

No.	Location	Species	Total	A			J			I	RI
				M	F	U	M	F	U		
14.	Wat Tham Sala, Nakhon Pathom.	f	64	7	34	-	16	2	-	5	0.1
			<b>67</b>	<b>11</b>	<b>26</b>	-	<b>12</b>	<b>5</b>	<b>1</b>	<b>12</b>	<b>0.5</b>
				(1 : 4.9)							
				<b>(1 : 2.4)</b>							
15.	Wat Khao Tham Kunchorn, Ratchaburi.	f	9	1	3	-	3	1	-	1	0.3
				(1 : 3)							
16.	Tham Chomphon, Ratchaburi.	f	216	24	79	-	30	40	2	41	0.5
				(1 : 3.3)							
17.	Wat Khao Chong- Phran, Ratchaburi.	f	20	3	10	-	2	2	1	2	0.2
				(1 : 3.3)							
18.	Wat Ngern Rung- Sawang, Ratchaburi.	f	26	5	10	-	5	2	-	4	0.4
				(1 : 2)							
19.	Wat Huai Takhaeng, Ratchaburi.	f	28	3	11	-	6	2	-	6	0.5
				(1 : 3.7)							
20.	Wat Khao Suan- Luang, Ratchaburi.	f	64	6	17	-	14	14	1	12	0.7
				(1 : 2.8)							
21.	Wat Ratch- Singhorn, Ratchaburi.	f	137	16	69	-	7	21	6	18	0.3
				(1 : 4.3)							
22.	Khao Sam Muk, Chonburi.	f	126	18	44	2	24	7	3	28	0.6
				(1 : 2.4)							
23.	Khao Wang Phetburi.	f	73	13	21	7	16	-	6	10	0.5
			<b>121</b>	<b>22</b>	<b>41</b>	-	<b>24</b>	<b>13</b>	<b>8</b>	<b>13</b>	<b>0.3</b>
				(1 : 1.6)							
				<b>(1 : 1.9)</b>							
24.	Wat Bun Thawi Phetburi.	f	50	9	20	-	10	-	3	8	0.4
			<b>35</b>	<b>2</b>	<b>7</b>	-	<b>8</b>	<b>6</b>	-	<b>12</b>	<b>1.7</b>
				(1 : 2.2)							
				<b>(1 : 3.5)</b>							
25.	Wat Kut Phetburi.	f	35	4	11	-	5	-	3	12	1.1
				(1 : 2.8)							
26.	Wat Khao Bandai- It, Phetburi.	f	35	6	12	1	8	-	6	2	0.2
			<b>5</b>	<b>2</b>	<b>1</b>	-	-	-	<b>2</b>	-	<b>0.0</b>
				(1 : 2)							
				<b>(1 : 0.5)</b>							

Table 4 (continued)

No.	Location	Species	Total	A			J			I	RI
				M	F	U	M	F	U		
27.	Wat Khao Takhrao, Phetburi.	f	11	4	1	-	6	-	-	-	0.0
				(1 : 0.2)							
			<b>17</b>	<b>3</b>	<b>5</b>	-	<b>7</b>	-	-	<b>2</b>	<b>0.4</b>
				(1 : 1.6)							
28.	Wat Khao Tamon, Phetburi.	f	114	30	37	-	11	5	5	26	0.7
				(1 : 1.2)							
29.	Wat Khao Tao Mo, Phetburi.	ar	22	7	5	-	-	-	6	4	0.8
				(1 : 0.7)							
			<b>31</b>	<b>9</b>	<b>6</b>	-	<b>3</b>	<b>6</b>	-	<b>7</b>	<b>1.2</b>
				(1 : 0.7)							
30.	Wat Khao Takieb, Prachuabkirikhan.	f	84	9	21	6	10	1	12	25	1.2
				(1 : 2.3)							
31.	Wat Thammikaram- Varaviharn, Prachuabkirikhan.	f	69	10	31	-	5	7	-	16	0.5
				(1 : 3.1)							
32.	Wat Tha Mai Lai, Chumphon.	f	3	-	2	-	1	-	-	-	0.0
33.	Wat Tham Sua, Krabi.	f	23	3	10	-	1	3	-	6	0.6
				(1 : 3.3)							
34.	Wat Khuha Sawan, Phatthalung.	f	56	6	16	1	17	6	5	5	0.3
				(1 : 2.7)							
			<b>51</b>	<b>8</b>	<b>23</b>	-	<b>5</b>	<b>5</b>	-	<b>10</b>	<b>0.4</b>
				(1 : 2.9)							
35.	Khao Noi & Khao Tang Kuan, Songkhla.	f	66	16	19	3	6	2	1	19	1.0
				(1 : 1.2)							
36.	Wat Khuha Phimuk, Yala.	f	44	3	14	-	10	3	8	6	0.4
				(1 : 4.7)							

Species : f - *Macaca fascicularis*  
 m - *Macaca mulatta*  
 as - *Macaca assamensis*  
 ar - *Macaca arctoides*

Age : A - adults  
 J - juveniles  
 I - infants  
 Sex : M - males  
 F - females  
 U - unknown

RI = Index of reproduction =  $\frac{\text{Number of infants}}{\text{Number of adult females}}$



Table 5. Degree of human-monkey interaction at 36 visited sites.

No.	Location	Provision <sup>1</sup>	Health <sup>2</sup>	Attitude <sup>3</sup>	Habitat <sup>4</sup>
1.	Wat Tham Pla	2	1	2	2
2.	Kumpawapi Park	1	2	1	1
3.	Kosumphi Forest Park	2	1	2	2
4.	Wat Ku Pra Kona	1	1	2	2
5.	Don Poo Tao	0	1	2	2
6.	Prang Koo	1	1	2	2
7.	Ban Wan	0	0	1	1
8.	Wat Ban Kan Yai	0	1	1	2
9.	Wat Khao Noh	1	1	2	2
10.	Wat Krieng Krai Klang	1	1	2	2
11.	Wat Khao Sompoad	1	1	2	2
12.	Sarn Pra Karn	2	1	1	0
13.	Wat Phra Buddha Chai	1	1	2	2
14.	Wat Tham Sala	1	0	2	0
15.	Wat Tham Kunchorn	0	1	1	2
16.	Tham Chomphon	1	1	2	2
17.	Wat Khao Chong Phran	0	1	1	2
18.	Wat Ngern Rung Sawang	0	1	1	2
19.	Wat Huai Takhaeng	1	1	2	2
20.	Khao Suan Luang	1	1	1	2
21.	Wat Ratch Singkhorn	2	1	1	2
22.	Khao Sam Muk	2	2	1	2
23.	Khao Wang	2	2	2	2
24.	Wat Bun Thawi	1	1	1	2
25.	Wat Kut	0	1	1	2
26.	Wat Khao Bandai It	0	1	0	2
27.	Wat Khao Takhrao	1	1	1	2
28.	Wat Khao Tamon	1	1	2	2
29.	Wat Khao Tao Mo	0	1	2	2
30.	Wat Khao Takieb	1	1	2	2
31.	Wat Thammikaram Varaviehan	1	1	1	2
32.	Wat Tha Mai-Lai	0	1	1	2
33.	Wat Tham Sua	0	1	1	2
34.	Wat Khuha Sawan	1	1	2	2
35.	Khao Tang Kuan	1	1	1	2
36.	Wat Khuha Phimuk	1	1	1	2

<sup>1</sup> 0 = occasionally provisioned; 1 = semi-provisioned; 2 = fully provisioned<sup>2</sup> 0 = undernourished, some with hair loss; 1 = healthy, normal weight; 2 = obese, or with distended belly, with or without hair loss<sup>3</sup> 0 = intolerant; 1 = indifferent; 2 = tolerant<sup>4</sup> 0 = no viable natural habitat left; 1 = some natural habitat left; 2 = adequate natural habitat left

a Thai village, but otherwise the general area consists of Muslim villages. Wat Khuha Phimuk is regularly visited by both locals and foreign tourists, especially Malaysians because Yala Province borders Malaysia. There is an old reclining Buddha image about 24 m long inside the cave. The Buddha image was built during the Sri Vichai era (757-857 A.D.) about 1,200 years ago. A giant demon about 3 m high stands at the cave's entrance, which was built after the World War II to remind people of the Japanese cruelty during the war.

**Habitat** : Rain forest on limestone covers an area of 50 ha on Khao Kampan. About 10 ha of this limestone mountain, including the temple and part of the forest, are under the care of Department of Religious Affairs but the other side of this mountain has been leased to a marble quarrying company.

**Monkeys** : There were about 44 long-tailed macaques on the steep hill which were fed by the monks, villagers and tourists in September, 1990. A monk informed me that these monkeys started coming down to get food from humans about four years ago after quarrying work started. The provisioned foods consist of left-over rice, seasonal fruits such as *Sapodilla*, star fruits, and bananas. Overall, the monkeys appeared healthy. Even though they received protection from the monks near the temple, some of them have been killed by villagers for food or medicinal purposes.

### Summary of Population Survey

Semi-tame colonies of macaques are found all over Thailand (Figure 5). Long-tailed macaques (*M. fascicularis*) are found mostly in the central plains and coastal areas; no colonies were discovered in north Thailand. Three colonies of Assamese macaques (*M. assamensis*) are found in north and northeastern regions (Wat Tham Pla, Wat Tham Tab Tao, and Wat Tham Khuha Varee). Only one colony of rhesus macaques is found in upper northeast Thailand (Kumpawapi Park), and two colonies of stump-tailed macaques are found in the central-west area, the largest being at Wat Khao Tao Mo.

The total number of semi-tame macaques counted was 2,728 during 1989-1991. These consisted of 2,538 *Macaca fascicularis* (33 colonies), 103 *M. mulatta* (one colony), 56 *M. assamensis* (one colony), and 31 *M. arctoides* (one colony). In areas that were visited twice, only the population size observed on the second visit was considered.

The average, minimum and maximum colony size of *M. fascicularis* was 77, 3 and 235, respectively. The total number of adults, juveniles, and infants of these macaques was 1,377, 676 and 485, respectively. The average sex ratio of adults was about 1 : 2.4 (male : female).

The colony of *M. mulatta* at Kumpawapi Park consisted of 19 adult males, 42 adult females, 18 juveniles and 24 infants. The small colony of *M. arctoides* at Wat Khao Tao Mo consisted of 9 adult males, 6 adult females, 9 juveniles and 7 infants. A colony of *M. assamensis* at Wat Tham Pla consisted of 9 adult males, 15 adult females, 12 juveniles and 20 infants.

Most of the colonies occur on limestone hills. Of the 36 sites visited, 28 sites appeared to have sufficient natural habitat, six sites had some habitat, and only two sites had no natural habitat.

Out of 36 sites, six sites were fully provisioned, 19 sites were semi-provisioned, and 10 sites were occasionally provisioned. Overall the monkeys from the 36 sites ap-

Table 6. Daily activity budget for whole day by age-sex of macaques at eight selected sites.

Activity Age/sex	Rest	Travel	Feed	Groom	Play	Aggres	Sexual	Total no. obs.
<b><i>Wat Koo Pra Kona (M. fascicularis)</i></b>								
Adult male	49.2	25.4	7.9	14.3	3.2	0.0	0.0	126
Adult female	50.6	23.7	8.9	16.4	0.0	0.5	0.0	427
Subadult	46.3	29.6	13.0	9.2	1.9	0.0	0.0	54
Juvenile	30.7	35.7	14.4	9.7	8.8	0.6	0.0	319
Infant	26.3	29.2	25.5	5.5	13.5	0.0	0.0	274
Pooled	39.4	28.6	14.3	11.6	5.8	0.3	0.0	1200
<b><i>Khao Sam Muk (M. fascicularis)</i></b>								
Adult male	41.7	22.1	21.7	11.5	0.8	0.8	1.3	235
Adult female	44.4	18.8	15.2	19.7	0.6	1.1	0.3	356
Subadult	42.1	23.3	22.0	10.1	2.5	0.0	0.0	159
Juvenile	36.2	28.2	14.4	11.5	9.2	0.6	0.0	174
Infant	31.6	24.6	14.6	10.5	18.1	0.6	0.0	171
Pooled	40.2	22.6	17.4	13.8	5.0	0.7	0.4	1095
<b><i>Wat Tham Sala (M. fascicularis)</i></b>								
Adult male	52.1	16.8	16.0	11.8	0.0	2.9	0.4	238
Adult female	43.0	19.9	22.2	14.3	0.0	0.5	0.0	572
Subadult	36.4	29.9	18.2	11.7	3.9	0.0	0.0	77
Juvenile	19.0	28.8	30.7	8.3	13.2	0.0	0.0	205
Infant	30.5	20.8	22.7	11.0	14.9	0.0	0.0	154
Pooled	38.8	21.5	22.2	12.3	4.3	0.8	0.1	1246
<b><i>Khao Wang (M. fascicularis)</i></b>								
Adult male	52.6	16.2	15.0	11.7	0.6	3.9	0.0	154
Adult female	48.5	17.6	16.8	15.3	0.4	2.6	0.0	262
Subadult	39.6	24.1	24.1	6.9	5.2	0.0	0.0	58
Juvenile	28.0	26.9	23.3	8.6	11.9	1.2	0.0	335
Infant	25.0	19.5	37.5	2.3	15.6	0.0	0.0	128
Pooled	38.1	21.3	22.1	10.0	6.9	1.5	0.0	937
<b><i>Wat Khuha Sawan (M. fascicularis)</i></b>								
Adult male	27.3	21.8	25.4	14.5	0.0	3.6	7.3	55
Adult female	35.2	26.0	28.1	9.7	0.0	0.0	1.0	196
Subadult	20.0	30.0	20.0	20.0	1.0	0.0	0.0	10
Juvenile	15.4	34.1	29.7	9.9	9.9	1.1	0.0	91
Infant	22.9	27.1	20.8	6.2	22.9	0.0	0.0	48
Pooled	27.8	27.5	27.0	10.3	5.3	0.8	1.5	400

Table 6 (continued)

Activity Age/sex	Rest	Travel	Feed	Groom	Play	Aggres	Sexual	Total no. obs.
<i>Wat Tham Pla (M. assamensis)</i>								
Adult male	38.5	26.1	12.3	15.4	3.1	4.6	0.0	65
Adult female	43.6	27.3	18.8	7.9	0.6	0.6	1.2	165
Subadult	15.4	42.3	19.2	3.8	15.4	3.8	0.0	26
Juvenile	31.8	20.4	17.4	8.0	21.4	1.0	0.0	201
Infant	18.9	32.8	15.6	6.1	26.7	0.0	0.0	180
Pooled	31.2	27.2	16.8	8.0	15.4	1.1	0.3	637
<i>Kumpawapi Park (M. mulatta)</i>								
Adult male	51.0	26.1	9.1	11.6	0.0	1.7	0.5	241
Adult female	46.7	20.3	12.1	19.3	0.0	1.1	0.4	522
Subadult	39.5	27.2	16.0	16.0	1.2	0.0	0.0	81
Juvenile	35.6	34.5	11.5	6.9	10.9	0.6	0.0	174
Infant	31.2	26.7	20.3	7.9	13.9	0.0	0.0	202
Pooled	43.0	25.0	13.0	13.9	3.9	0.9	0.2	1220
<i>Wat Khao Tao Mo (M. arctoides)</i>								
Adult male	39.8	24.2	23.4	7.8	0.0	4.7	0.0	128
Adult female	33.6	23.0	29.2	13.3	0.0	0.9	0.0	113
Subadult	25.0	33.3	31.2	8.3	0.0	2.1	0.0	48
Juvenile	30.2	30.2	29.4	8.4	0.0	1.7	0.0	119
Infant	42.1	21.0	24.6	5.3	7.0	0.0	0.0	57
Pooled	34.6	26.0	27.3	9.0	0.9	2.2	0.0	465

peared healthy (without distended belly or hair loss), but those at three sites appeared obese, and at two sites, undernourished.

Of the 36 sites, the attitude of humans towards the monkeys in 18 sites was moderate (indifferent). At 17 sites people willingly tolerated them, and only at one site was intolerance found.

## BEHAVIORAL OBSERVATIONS

A brief summary of the behavior of monkeys at the eight selected study sites is given here. Detailed activity budgets are included in AGGIMARANGSEE (1992).

(1) The daily activity budgets for *M. fascicularis* at Wat Koo Pra Kona (north-east), Khao Sam Muk (southeast), Wat Tham Sala (central plains), Khao Wang (upper peninsula) and Wat Khuha Sawan (lower peninsula) showed that they spent most of their time (average of 37%) resting throughout the day. Traveling (24%) and feeding (21%) were the second and third ranked behaviors. Grooming activity was uniform throughout

Table 7. Percentage of solid food eaten by macaques at eight selected sites (see Table 3 for list of sites).

Solid food	Site and species code							
	1 . f	2 . f	3 . f	4 . f	5 . f	6 . as	7 . m	8 . ar
<i>Natural foods</i>								
Fruits	18.3	0.6	4.7	6.8	40.0	2.7	14.9	5.6
Flowers	0.0	4.2	13.6	2.6	0.0	4.1	2.1	2.8
Leaves	44.1	12.1	40.8	10.2	5.6	21.9	33.0	60.2
Barks	3.2	1.2	2.3	2.6	0.0	0.0	2.1	5.6
Insects	4.3	0.0	0.0	0.0	4.4	0.0	4.2	0.9
<i>Provisioned foods</i>								
Rice	23.6	3.0	22.5	1.7	30.0	5.5	11.7	10.2
Eggs	0.0	6.1	0.5	0.8	1.1	0.0	0.0	0.0
Fruits	5.4	29.7	13.1	38.5	16.7	38.4	3.2	14.8
Vegetables	1.1	43.0	2.3	36.8	2.2	27.4	28.7	0.0
Total no. obs.	93	165	213	117	90	73	94	108

Table 8. Frequencies and percentages of solid food eaten by macaques at eight selected sites. Percentages are given in brackets.

Location	Food		Total no. obs
	Natural	Provisioned	
1. Wat Koo Pra Kona	65 (69.9)	28 (30.1)	93
2. Khao Sam Muk	30 (18.2)	135 (81.8)	165
3. Wat Tham Sala	131 (61.5)	82 (38.5)	213
4. Khao Wang	26 (22.2)	91 (77.8)	117
5. Wat Khuha Sawan	45 (50.0)	45 (50.0)	90
6. Wat Tham Pla	21 (28.8)	52 (71.2)	73
7. Kumpawapi Park	53 (56.4)	41 (43.6)	94
8. Wat Khao Tao Mo	81 (75.0)	27 (15.0)	108

Table 9. Frequencies and percentages of various substratum used by macaques during active hours at eight selected sites. Percentages given in brackets.

Location	Substratum			Total no. obs.
	Natural	Vegetation	Artificial	
Wat Koo Pra Kona	794 (66.2)	302 (25.2)	104 (8.7)	1200
Khao Sam Muk	462 (42.3)	217 (19.9)	413 (37.8)	1092
Wat Tham Sala	531 (42.8)	578 (46.5)	133 (10.7)	1242
Khao Wang	415 (44.3)	313 (33.4)	209 (22.3)	937
Wat Khuha Sawan	99 (24.8)	176 (44.0)	125 (31.2)	400
Wat Tham Pla	164 (25.7)	343 (53.8)	130 (20.4)	637
Kumpawapi Park	322 (26.4)	567 (46.5)	331 (27.1)	1220
Khao Tao Mo	296 (63.6)	143 (30.8)	26 (5.6)	465

Table 10. Index of naturalness of substratum and solid food by macaques at eight selected sites.

Location	Area of range (ha)	Index of naturalness of	
		substratum	solid food
Wat Koo Pra Kona	42	0.9	0.7
Khao Sam Muk	125	0.6	0.2
Wat Tham Sala	5	0.9	0.6
Khao Wang	33	0.8	0.2
Wat Tham Khuha Sawan	55	0.7	0.5
Wat Tham Pla	94	0.8	0.3
Kumpawapi Park	20	0.7	0.6
Wat Khao Tao Mo	55	0.9	0.8

$$\text{Index of naturalness of substratum} = \frac{\text{frequency of (vegetation + natural substratum)}}{\text{frequency of all substratum}}$$

$$\text{Index of naturalness of solid food} = \frac{\text{frequency of natural food}}{\text{frequency of all solid food}}$$

the day (Figure 15). Overall, play behavior of long-tailed macaques was uniform with the average of 5%

(2) *M. mulatta* at Kumpawapi Park (northeast Thailand) spent more time resting (43%) than at other activities (travel 25%, feed 13%, groom 14%).

(3) *M. arctoides* at Wat Khao Tao Mo (upper peninsula) spent about 35% of time resting while traveling (26%) was similar to feeding (27%). Play activity (ca. 1%) of these macaques was very low.

(4) The activities of *M. assamensis* at Wat Tham Pla (north Thailand) were 31% resting, 27% traveling and 16.8% feeding. Play activity (15%) of these macaques was higher than that of other macaques.

(5) Ranges of *M. fascicularis* at the five sites varied from 5 to 125 ha (mean=52) during the periods of my visit. *M. assamensis* at Wat Tham Pla ranged over 94 ha. *M. mulatta* at Kumpawapi Park ranged over 20 ha. *M. arctoides* at Wat Khao Tao Mo ranged over 55 ha.

(6) The monkeys living at popular tourist sites (*M. fascicularis* at Khao Sam Muk and Khao Wang, *M. assamensis* at Wat Tham Pla) fed more on provisioned food than those living at less popular tourist sites (*M. fascicularis* at Wat Tham Sala, Wat Koo Pra Kona, Wat Khuha Sawan and *M. mulatta* at Kumpawapi Park) (Table 8).

(7) *M. fascicularis* at all sites used natural substratum including trees more than artificial substratum. The average natural substratum use was about 71% of observations. The macaques at Khao Sam Muk, however, tended to use more artificial substratum due to provisioning.

(8) The index of natural substratum use of *M. arctoides* at Wat Khao Tao Mo was high (0.9). They restricted themselves to the natural substratum because of chasing by temple dogs.

(9) *M. mulatta* at Kumpawapi park tended to share habitat with humans because they lived in a very limited area. The index of naturalness of substratum used was 0.7.

(10) The index of natural substratum used by *M. assamensis* at Wat Tham Pla was similar to that of *M. fascicularis* at Khao Wang (0.8).

## DISCUSSION

### Population Sizes and Trends

There were at least 2,728 semi-tame macaques censused in this study in Thailand, 1989-1991. Of the total, 103 were *M. mulatta*, 56 were *M. assamensis*, 31 were *M. arctoides*, the rest (2,538) were *M. fascicularis*. The database of Center for Conservation Biology, Mahidol University, however, has expected the total population sizes of *M. nemestrina*, *M. fascicularis*, *M. arctoides*, *M. assamensis*, and *M. mulatta* in protected areas under the Royal Forestry Department (RFD) as 11,824, 7,000, 5,299, 3,987, and 1,800, respectively. Although the long-tailed macaque is the most common monkey occurring on coastal areas or lowland limestone forests in Thailand (FOODEN, 1971; LEKAGUL & MCNEELY, 1977) the expected population within protected areas is much smaller than that of pig-tailed macaques which occur in the upland forests. Upland forest is better represented in the protected area system than are coastal and lowland habitats of the plains.

### *Macaca fascicularis*

The average colony size of these semi-tame long-tailed macaques at 33 study sites was found to be 77 individuals (range : 3-235; Table 4).

FOODEN (1971) stated that troop size of wild long-tailed macaques in Thailand varied from seven to 100; the mean size of eight groups was 39. KURLAND (1973) in ALDRICH-BLAKE (1980) estimated mean size of 12 wild long-tailed macaque groups in Kutai, East Kalimantan to be 18 individuals, which was smaller than that of Fooden's study. ALDRICH-BLAKE (1980) observed a group of long-tailed macaques consisting of 23 individuals in Kuala Lompat. KOYAMA (1985a) estimated mean size of wild long-tailed macaques at Gunung Meru, Indonesia to be about 41 individuals. LUCAS & CORLETT (1991) studied a partly provisioned troop of 30-40 long-tailed macaques in a tropical rain forest reserve.

At the Khao Sam Muk site in southeast Thailand, CHAWALSILP (1981) observed a troop of about 60 long-tailed macaques during 1980-1981. MEESWAT (1981) estimated the total number of these macaques in three groups at the same site to be 100-150 individuals. I observed two groups at this site consisting of 62 and 64 monkeys in late 1990.

Overall, adult sex ratio of long-tailed macaques in Thailand (adult males : adult females was ca. 1 : 2.4). KOYAMA (1984), however, reported the adult sex ratio of long-tailed macaques from three troops to be 1 : 3.3, 1 : 1.4, and 1 : 11. KOYAMA (1985b) reported the sex ratio of the same macaques to be 1 : 3, similar to those in my study. He did not mention about provisioning at his study site.

It appears that semi-tame colonies achieve larger group sizes, on average, than wild populations probably because they cannot easily split up or disperse from the groups.

### *Macaca mulatta*

SOUTHWICK et al. (1961a; 1965) found that the average group sizes of wild (ca. 50) and temple (ca. 42) rhesus macaques in northern India were much larger than those at roadsides (ca. 15), villages (ca. 17) and towns (Eimerl & De Vore, 1974). Group size of forest troops, however, was quite similar to that of temple troops. MUKHERJEE & MUKHERJEE (1972) observed nine troops of rhesus monkeys in northern India varying from 21 to 236. The average group size of these colonies was about 93 and the adult sex ratio of male per female was 1 : 1.9. KOFORD (1965) observed six artificial groups of rhesus macaques consisting 30, 30, 31, 43, 117 and 122 individuals on Cayo Santiago (a wooded 16-ha islet off the east coast of Puerto Rico). The mean size of these colonies was about 62. FOODEN (1971) collected a mature lactating female specimen from a troop of about 20 individuals in western Thailand in 1967. In this study, the town colony rhesus macaques at Kumpawapi Park in northeastern Thailand, numbered 103 individuals, much larger than the average for Southwick's town groups (22.4). The average adult sex ratio of the colony of rhesus at Kumpawapi Park, Thailand was about 1 : 2.2 which was quite similar to that of Southwick's colonies.

### *Macaca arctoides*

FOODEN (1971) collected two specimens of stump-tailed macaques from a large band of about 50 individuals. The colony of stump-tailed macaques at Wat Khao Tao Mo,



Phetburi Province was observed by U. Treesucon in June, 1984 (TREESUCON, 1988). It consisted of seven adult males, five adult females, six juveniles and four infants (total 22). The same colony had 31 individuals in early 1991. The size of this colony has apparently increased. The adult sex ratio was about 1 : 1.

### *Macaca assamensis*

FOODEN (1971) stated that troop size of Assamese macaques varied from 10 to 50 individuals. The two groups in a semi-tame colony of *M. assamensis* at Wat Tham Pla, northern Thailand consisted of 29 and 27 individuals in early 1991. The sex ratio of this colony (male : female) was about 1 : 1.7.

Most of the colonies surveyed in this study are now genetically isolated from other populations. Therefore, it is possible to treat them as separate subpopulations and assign a risk category to them which will reflect the probable time to extinction of each subpopulation.

To have a better understanding of population sizes and trends, the status of primates at 21 isolated sites visited were assigned with categories of threat based on Mace-Lande categories (MACE & LANDE, 1991). The three categories are :

*Critical* : probability of extinction is 50% within five years or two generations, whichever is longer; or  $N_e < 50$  and  $N < 250$ .

*Endangered* : probability of extinction is 20% within 20 years or ten generations, whichever is longer; or  $N_e < 500$  and  $N < 2,500$ .

*Vulnerable* : probability of extinction is 10% within 100 years or  $N_e < 2,000$  and  $N < 10,000$ .

Measures of effective population size ( $N_e$ ) are used to define these categories, and approximate equivalents in actual population sizes ( $N$ ) are given in Table 11. The primates at 14 sites are categorized as critical, while the primates at the remaining seven sites are categorized as endangered.

The above categories were based on measures of effective population size ( $N_e$ ) and actual population size ( $N$ ). According to S. WRIGHT (1931) in HEDRICK (1983), the concept of effective population size allows consideration of an ideal population of size  $N$  in which all parents have an equal expectation of being the parents of any progeny. A number of factors, however, can cause deviations from this theoretical ideal.

The factors that were encountered in the macaque colonies surveyed that cause deviations were social ranking of breeding individuals, access to mates and mate selection. Thus, the categories used could be overestimates of the true effective population sizes.

These categories are nevertheless useful in a crude survey such as this. A long term study, however, is required to consider the various factors that cause deviations from ideal populations. The results indicate that unless the colonies are managed and protected from threats, their survival over the long term is doubtful.

An index of reproduction (RI) of macaques at each site was calculated to help understand the population trends of these monkeys (Table 4). The index of reproduction is the average number of infants per adult female. If  $RI=1.0$ , then every adult female is breeding and this may indicate that the population has a high potential to survive.

In Thailand, the long-tailed macaque colonies which have been isolated for many

Table 11. Status of macaques categorized by Mace-Lande Categories at 21 sites which are now isolated.

No.	Location	Species	N	$N_e$	Status
1.	Wat Koo Pra Kona, Roi Et.	f	121	47	C
2.	Don Poo Tao, Yasothon.	f	42	12	C
3.	Prang Koo, Yasothon.	f	12	3	C
4.	Ban Wan, Si Saket.	f	100	38	C
5.	Wat Ban Kan Yai, Si Saket.	f	15	8	C
6.	Wat Khao Noh, Nakhon Sawan.	f	179	75	E
7.	Wat Krieng Krai Klang, Nakhon Sawan.	f	195	102	E
8.	Sarn Pra Karn, Lopburi.	f	104	24	C
9.	Wat Tham Sala, Nakhon Pathom.	f	67	31	C
10.	Wat Khao Tham Kunchorn, Ratchaburi.	f	9	2	C
11.	Tham Chomphon, Ratchaburi.	f	216	74	E
12.	Wat Khao Suan Luang, Ratchaburi.	f	64	18	C
13.	Khao Sam Muk, Chonburi.	f	126	51	E
14.	Khao Wang, Phetburi.	f	121	57	E
15.	Wat Kut, Phetburi.	f	35	12	C
16.	Wat Khao Takhrao, Phetburi.	f	17	8	C

Table 11 (continued)

No.	Location	Species	N	N <sub>e</sub>	Status
17.	Wat Khao Tamon, Phetburi.	f	114	66	E
18.	Wat Khao Takieb, Prachuabkirikhan.	f	84	25	C
19.	Wat Thammikaram Varaviharn, Prachuabkirikhan.	f	69	30	C
20.	Kumpawapi Park, Udon Thani.	m	103	52	E
21.	Wat Khao Tao Mo, Phetburi.	ar	31	14	C

## Abbreviations:

N = Total population size; N<sub>e</sub> = Effective population sizeas = *M. assamensis*; ar = *M. arctoides*; f = *M. fascicularis*; m = *M. mulatta*

C = critical; E = endangered

years such as those at Khao Sam Muk, Khao Wang, Tham Chomphon, Sarn Phra Karn, Wat Khao Tamon, Khao Noh, Wat Krieng Krai Klang and one colony of rhesus macaques at Kumpawapi Park are quite stable. Interviews with local people indicated that the monkeys' population size has not changed much within memory. Moreover, the RI of these colonies was quite high (range 0.4 to 0.7)

The population sizes of many colonies such as those at Wat Tham Sala, Wat Khao Takrao, Ban Wan, Wat Ban Kan Yai, Wat Koo Pra Kona, Don Poo Tao, Wat Kut, Wat Thammikaram, Wat Khao Tham Kunchorn and Wat Khao Suan Luang have tended to be declining, even though their RI were not low (range 0.2 to 1.1). It seems that their infant mortalities must be quite high, judging from the ratio of juveniles to infants (Table 4). The juvenile stage is 2-3 years long. In several colonies, the number of infants exceeds or is nearly equal to the number of juveniles which, in a stationary population, would indicate high infant or early juvenile mortality. Many infants in these colonies appeared to be small in size—perhaps stunted—even well after the birth season. The evidence thus suggest that population control is achieved in these colonies through high mortality of young, and not through birth spacing or reduction of reproduction.

The colony of *M. arctoides* at Wat Khao Tao Mo may have increased recently. U. TREESUCON (1988) censused this colony in June, 1984 as having seven adult males, five adult females, six juveniles and four infants. thus the N<sub>e</sub> and RI of this colony were about 11.7 and 0.6, respectively, which are slightly smaller than in my survey in February, 1991 (N<sub>e</sub>=14, RI=1.2).

Overestimation of RI may have occurred in some colonies such as those of *M. fascicularis* at Wat Bun Thawi, Wat Kut, Wat Khao Takieb and *M. arctoides* at Wat Khao Tao Mo (Table 4). It may be caused by:

- (1) counting some infants more than once;
- (2) miscounting adult females;
- (3) identifying some juveniles as infants, because of their very slow growth rate;
- (4) production of twins;
- (5) death of some mothers, because of hunting, accident or disease.

SOUTHWICK & SIDDIQI (1968) anticipated that in rural villages, the unprotected groups of monkeys would probably continue to decrease in number and size, whereas the groups protected by local people would flourish and increase in size. In towns, rhesus will probably continue to increase until they exceed the tolerance of local citizens, at which point people may then reduce their numbers.

In Thailand, the future of semi-tame monkeys in many temples is not much different from that of Indian rhesus monkeys. They will probably survive since they are protected by the temple authorities, even though some are occasionally shot, captured, or hit by cars. The monkeys, however, are facing some major problems over the long term. The most important problem is probable deterioration and gradual loss of habitat.

### **Habitat Loss**

Shrinking habitats have brought the monkeys into closer contact with humans. Over time, the monkeys have modified their behavior and adapted to human presence, though not without many casualties. The pressure on their habitats, however, has never ceased. So the monkeys started recognizing areas where they could seek refuge with little fear of being killed, and where there was ample food supply. For example, long-tailed macaques at Wat Khuha Phimuk (lower peninsula), Khao Noh, Wat Ratch Singkhorn (central plain) took refuge in the temple grounds when their habitats began to be converted to limestone quarries. Colonies of long-tailed macaques were reported seeing emigrating from Khao Sam Ngam to Wat Khao Tham Kunchorn and other nearby hills. A colony of long-tailed macaques became confined to a small hill in Wat Khao Takhrao (upper peninsula) since they had lost their habitats to prawn farms. Now, the rare species (*M. arctoides* and *M. assamensis*) are facing habitat loss caused by crop expansion in their original habitats.

VANCATOVA (1991) stated that populations of the same species living under different environmental condition could develop differences in their social structure. He observed that aggressive behavior of rhesus and stump-tailed macaques in small areas was higher than in those living in larger areas.

### **Attitudes and Hunting by Local People**

Monkeys that occur outside protected forested areas are usually subjected to hunting. They are either killed for meat or because they are pests to crops and property. They are killed for meat not so much as a supplementary source of protein but rather as an exotic food item or a delicacy. For example, rhesus monkeys were hunted mainly for medicinals on Hainan Island, China (JIANG *et al.*, 1991). Thais have a penchant for wildlife meat.



Figure 14. An adult male *M. fascicularis* at Kosumpho Forest Park, Mahasarakham Province (northeast Thailand) licking a stick of ice cream.



Figure 15. Grooming activity among adult females *M. fascicularis* at Khao Sam Muk, Chonburi Province (south-east Thailand). An infant was suckling breast milk.

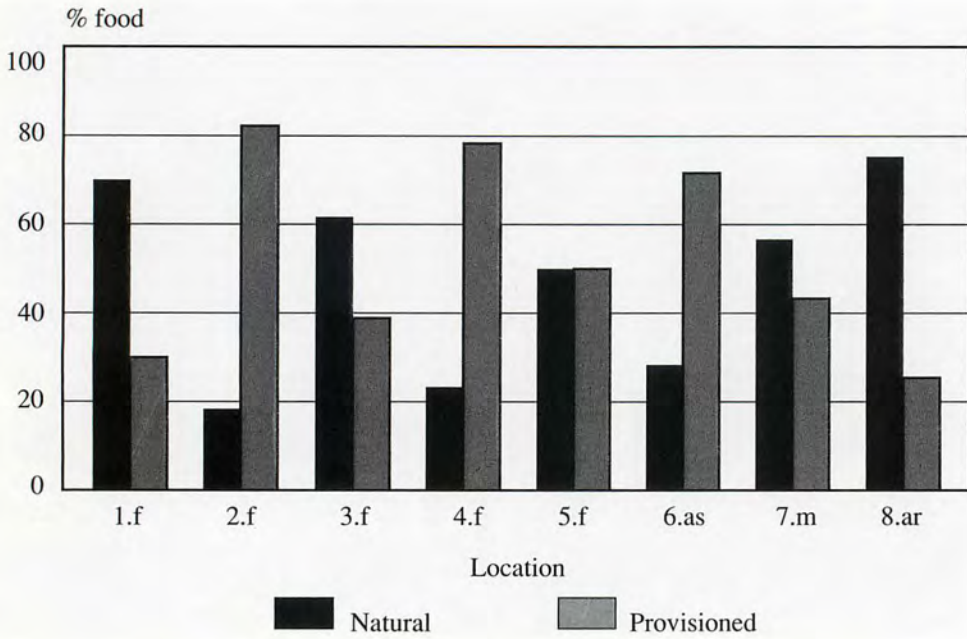


Figure 16. Percentage of solid food eaten by macaques at eight sites.

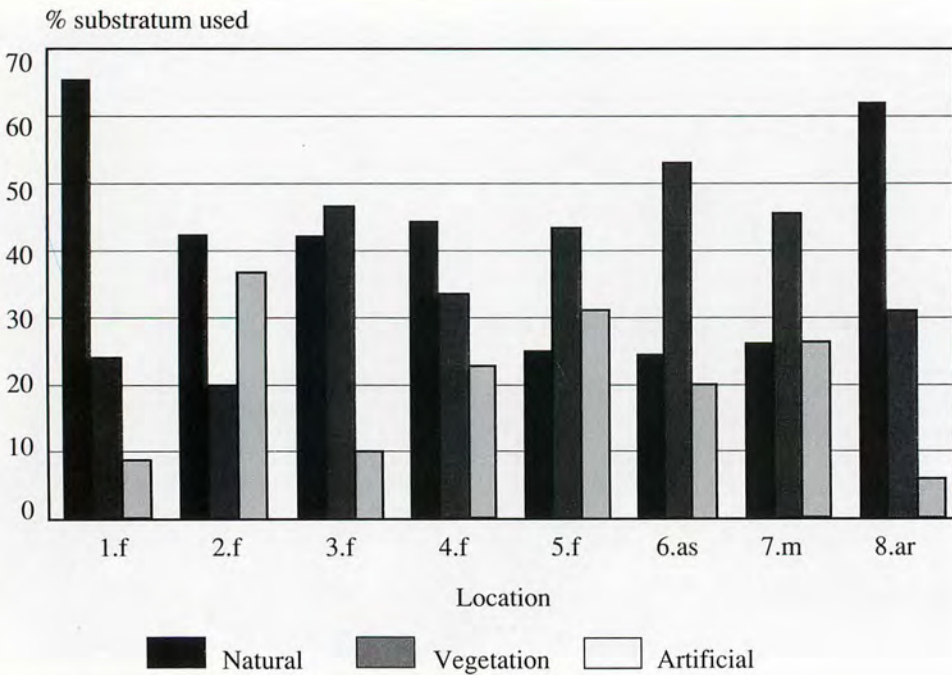


Figure 17. Percentage of substratum used by macaques at eight sites.

INSKIPP & BARZDO (1987) reported that macaques in Thailand are also threatened by the live animal trade for pets, medicinal research, zoos, etc.

In Thailand, the people are predominantly Buddhists and Buddhist teachings abhor the senseless killing of any form of life. Unfortunately, this usually applies in practice only within Buddhist sacred places, such as temples, monasteries and shrines. Monkeys are usually killed when they venture far out of the compounds of such places.

The attitudes of Thai people toward the monkeys at the 36 sites surveyed were mostly indifferent (18) or tolerant (17). At only one site (Wat Khao Bandai It, upper peninsula) did people appear intolerant toward the monkeys (Table 5).

SOUTHWICK *et al.* (1965) suggested that rhesus monkeys can exist in villages and towns only by the tolerance and consent of the people, a tolerance that has been maintained for centuries by social tradition and religious custom. Temples can be "refugia" for the monkeys and other wildlife (SOUTHWICK *et al.*, 1961a;b).

### Ranging

At sites where the temples, shrines, parks have small compounds and are not situated near forested areas, the monkeys' ranging patterns are severely restricted. Generally, the monkeys are viewed as pests and are a nuisance. They are either killed or beaten with sticks, or stones are thrown at them. Therefore, these monkeys rarely venture out of the compound. They do so at great risk, and usually go only if the temple is situated close to a forest.

Ranging is also affected by the food supply available. If it is abundant and always available, there is no need for the monkeys to range far in search for it (BENNETT & CALDECOTT, 1989; CALDECOTT, 1986; SIMONDS, 1974). From this survey, the home range of those macaques varied from five to 94 ha (eight sites). The average range size of *M. fascicularis* at five selected sites was 31 ha. The home range of wild long-tailed macaques at Kuala Lompat reported by BENNETT & CALDECOTT (1989) was 35 ha. The *M. fascicularis* at Kuala Lompat restricted themselves to the richest food habitat (riverine forest). They did not range into the tall dipterocarp forest which was occupied more by *M. nemestrina*. Pig-tailed macaques have much wider home ranges than long-tailed macaques. CALDECOTT (1986) reported that *M. nemestrina* in a rich habitat had a smaller home range (70 ha) than in less rich habitat (800 ha).

Ranging of macaques tended to be affected by provisioning. The long-tailed macaques at Khao Sam Muk tended to restrict themselves to the provisioning sites (ca. 20 ha). W.Y. Brockelman (*pers. comm.*) had seen these monkeys ranging over the whole hill (125) during the study of MEESWAT (1981).

LUCAS & CORLETT (1991) observed that a partly provisioned troop of long-tailed macaques at Bukit Timah Nature Reserve in Singapore (1986-1987) had about 70% of their 33-ha home range in primary forest. The long-tailed macaques at five selected sites of my survey ranged from five to 55 ha. The average range size was 31 ha which was quite similar to Lucas & Corlett's observations.

The colony of rhesus monkeys living in a limited habitat at Kumpawapi Park (northeastern Thailand) ranged over about 20 ha. The home range of rhesus macaques in Asarori forest at the foot of the Himalayas was, however, observed by MAKWANA (1978) to be 1.3–13.4 km<sup>2</sup>.

An isolated colony of *M. arctoides* at Wat Khao Tao Mo (central Thailand) ranged over about 55 ha. The colony of *M. assamensis* at Wat Tham Pla ranged over the whole hill, an area of about 94 ha.

### Provisioning

Temples, beside providing a safe refuge, also assure food supply through provisioning. At sites where there is little or no forest cover, provisioning is important to the monkeys' survival. At sites where there is viable forest cover and where provisioning is frequent, such as tourist sites, the monkeys are usually overfed, making them less active and obese. They have become overly dependent on provisioning for their food supply. Travel activity of macaques living at unpopular sites (low provisioned) tended to be higher than those living at popular sites (high provisioned). Resting, however, had no relation to provisioning. SOUMAH & YOKOTA (1991) found that free-ranging Japanese monkeys, especially high ranking females, fed more on artificial foods than natural ones. LUCAS & CORLETT (1991) observed that long-tailed macaques living at Bukit Timah, Singapore fed in about 14% of dietary observations on provisioned food, usually bread, fruits and peanuts. Daily activity of long-tailed, stump-tailed, rhesus and Assamese macaques seemed to be affected by provisioning. Long-tailed macaques at Khao Sam Muk and Khao Wang (popular sites visited) fed on provisioned food throughout the day, especially on weekends. They tended to shift their activities whenever tourists came. Long-tailed macaques at Wat Tham Khuha Sawan and stump-tailed macaques at Wat Khao Tao Mo came down from the hill for a short visit at mid morning for left-over breakfast before climbing up the hill, and came down again in the afternoon for left-over lunch items. They also foraged in rubbish dumps.

The percentage of provisioned food eaten by the macaques at eight selected sites ranged from 25% to 82% (Table 8; Figure 16). The average amount of provisioned food of long-tailed macaques at my five selected sites was 56%. The monkeys living in popular tourist sites fed the most on provisioned food. The major provisioned foods were fruits and vegetables. They also fed partly on rubbish.

Out of the 36 visited sites, 10 sites were occasionally provisioned, 31 sites were semi-provisioned, and six sites were fully provisioned (Table 5).

Provisioning with fruits and vegetables is not harmful to the monkeys, but at many sites the monkeys are provisioned with rice and other carbohydrate-rich foods which is detrimental to the monkeys' health. The monkeys developed distended belly due to excessive food that was unbalanced.

### Monkeys' Health

Monkeys living near human habitation usually appear in poor health and experience hair loss, skin infection, etc. (SOUTHWICK & SIDDIQI, 1968). This may be caused by the increased possibilities of disease transmission (SHAH & SOUTHWICK, 1965 in SOUTHWICK & SIDDIQI, 1968 and malnutrition (ZIMMERMANN *et al.*, 1975).

In Thailand, the monkeys living near human habitat often appeared either undernourished or obese. Out of the 36 visited sites, two sites had monkeys which



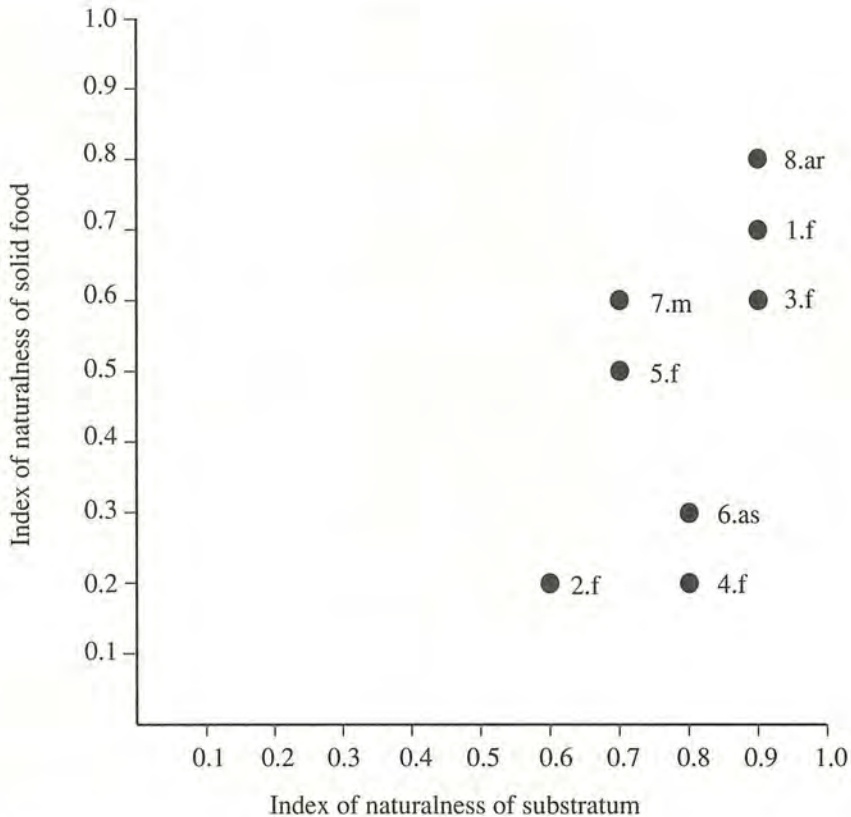


Figure 18. The relation of naturalness of substratum used and solid food eaten by macaques at eight selected sites.

appeared undernourished while those in three sites were obese. Overall, however, the macaques at most sites appeared to be healthy (Table 5).

## R E C O M M E N D A T I O N S

(1) *Habitat* : Viable natural habitat is needed for the survival of monkeys. The habitat provides food sources, sleeping sites, refuges, etc. The monkeys that live in limited areas tend to be undernourished. They need access natural habitats to obtain balanced diets by feeding on leaves, flowers, fruits, etc.

(2) *Attitudes* : Monkeys are usually hunted when they travel out of the protected areas. They are either killed for meat or as pests to crops and property. To conserve monkeys and other wildlife, people should change their attitudes towards the monkeys. They should not keep wildlife captive in houses, private zoos, or even in temples because there are very limited chances for surviving there. Moreover, captive animals tend to be more aggressive than free living ones (DEAG, 1977).

(3) *Diets* : Partial provisioning of the monkeys in limited areas provides enough food for survival. The type of food, however, must be considered. High carbohydrate foods such as glutinous rice make the monkeys obese and less active and should be avoided. Provisioning should not be allowed in sites with ample natural habitat available because the monkeys will tend to forage for natural foods less and consume poorer diets. Moreover, they tend to become more aggressive toward humans.

At tourist sites, the provisioning area should be limited to keep the place clean. The rubbish bins should be properly closed to prevent the monkeys from eating garbage and indigestible objects such as plastic bags. This may also help prevent monkeys from receiving human diseases.

(4) *Research* : Most of the colonies are facing the problems of inbreeding due to living in isolation from other colonies. Long-term monitoring of population dynamics, especially infant birth and mortality in the colonies, is needed to obtain data on demographic changes and population control mechanisms.

Behavioral and genetical studies of *M. assamensis* at Wat Tham Pla (north Thailand) and *M. arctoides* at Wat Khao Tao Mo (upper peninsula) are suggested since they are rare species, and living in isolated pockets of habitat.

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## Appendix I : Names of animals mentioned in the text.

Scientific name	Common name
<b>Birds</b>	
<i>Amaurornis phoenicurus</i>	white-breasted waterhen
<i>Anas crecca</i>	common teal
<i>Anthracoceros albirostris</i>	Indian pied hornbill
<i>Corvus macrorhynchos</i>	large billed crow
<i>Gallus gallus</i>	red junglefowl
<i>Lophura nycthemera</i>	silver pheasant
<i>Leptoptilos</i> spp.	adjutant
<i>Myiophoneus caeruleus</i>	blue whistling thrush
<i>Nycticorax nycticorax</i>	black-crowned night heron
<i>Pandion haliaetus</i>	osprey
<i>Pavo muticus</i>	green peafowl
<i>Pitta</i> spp.	pitta
<i>Porphyrio porphyrio</i>	gallinule or purple swamphen
<i>Sturnus nigricollis</i>	black-collared starling
<i>Tyto alba</i>	barn owl
<i>Urocissa erythrorhyncha</i>	blue magpie
<b>Mammals</b>	
<i>Canis aureus</i>	Asiatic jackal
<i>Capricornis sumatraensis</i>	serow
<i>Cervus eldi</i>	brow-antlered or Eld's deer
<i>Cervus unicolor</i>	sambar deer
<i>Felis temmincki</i>	Asian golden cat
<i>Felis unicolor</i>	leopard cat
<i>Felis viverina</i>	fishing cat
<i>Helarctos malayanus</i>	Malayan sun bear
<i>Herpestes javanicus</i>	Javan mongoose
<i>Hylobates lar</i>	white-handed gibbon
<i>Hystrix brachyura</i>	Malayan porcupine
<i>Macaca arctoides</i>	stump-tailed macaque
<i>Macaca assamensis</i>	Assamese macaque
<i>Macaca fascicularis</i>	long-tailed macaque
<i>Macaca mulatta</i>	rhesus macaque
<i>Macaca nemestrina</i>	pig-tailed macaque
<i>Manis</i> spp.	pangolin
<i>Muntiacus muntjak</i>	common barking deer
<i>Nycticobus coucang</i>	slow loris
<i>Paguma larvata</i>	masked palm civet
<i>Panthera pardus</i>	leopard

## Appendix I (continued)

Scientific name	Common name
<i>Panthera tigris</i>	tiger
<i>Paradoxurus hermaphoditus</i>	common palm civet
<i>Selenarctos thibetanus</i>	Asiatic black bear
<i>Sus scrofa</i>	common wild boar
<i>Trachypithecus obscurus</i>	dusky langur
<i>Tragulus javanicus</i>	lesser mouse deer
Family <i>Sciuridae</i>	squirrels, flying squirrels
<b>Reptiles</b>	
<i>Naja naja</i>	common Indian cobra
<i>Python</i> spp.	python
<i>Varanus salvator</i>	water monitor lizard
Family <i>Testudinidae</i>	tortoises