

The Dominant Species of Monkeys (*Macaca fascicularis*) in Northern Region of Peninsular Malaysia

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Abstract.- A comprehensive population study of three monkey species (i.e. *Macaca fascicularis*, *Macaca nemestrina* and *Trachypithecus obscurus*) was piloted to determine the dominant species, population quantity and group size. The survey was conducted between November 2011 and May 2012. The technique adapted for the study was scan sampling method; Population survey showed that there were 23 groups of 508 individuals of three monkeys' species in three states of Peninsular Malaysia (Penang, Kedah and Perak). One-Way Anova test was used to find the significant difference among above three species and to compare their means. Adult males showed a significant difference between two species in terms of population (i.e. *Macaca fascicularis* and *Macaca nemestrina* and p-value is $p < 0.01$). Adult females, sub-adults and juveniles were found to be significant as compared to *Macaca fascicularis* and *Macaca nemestrina* which were found $p < 0.008$, $p < 0.01$ and $p < 0.04$ respectively. The infants were found non-significant and *Trachypithecus obscurus* showed no variation in comparison with other two species. The survey discovered that the *Macaca fascicularis* was the most dominant species of Peninsular Malaysia. It was noted that the population of *Macaca nemestrina* was declining and the population of *Trachypithecus obscurus* was stable species of Peninsular Malaysia.

Key words: *Macaca fascicularis*, peninsular Malaysia, scan sampling.

INTRODUCTION

Monkeys are well known globally especially the long-tailed macaques. *Macaca fascicularis* of Southeast Asia is pervasive but quickly declining in terms of population. They face many threats including environmental damages and habitat loss with increasing human populations in both urban and rural sceneries, as well as trade and trapping for pharmaceutical testing, research, and development (Eudey, 2008).

Due to the large population of *Macaca fascicularis* the numbers among the other species of macaques are very limited in the area. They are adaptable with humans as compared to other species of macaques. According to Angst 1975, long tailed macaques adopt themselves in the areas that other primates do not exist. They have close proximity in behaviors with human in their natural habitat (Wong and Ni, 2000). *Macaca fascicularis* has been established clearly in an extensive range of habitats in mangrove, built-in with human, swamp, riverine and coastal forest (Wolfheim, 1983). They modify

well to change their surroundings and live in an environment that suitable for them (Wheatley, 1999) and they are used to live around human settlement and agricultural fields (Fuentes *et al.*, 2005).

Malaysia consists of 229 species of mammals (Md-Zain *et al.*, 2011b) containing twenty species of primates (Md-Zain *et al.*, 2009). Among these species three species are very common and recognizable amongst Malaysian people (i.e., *Macaca fascicularis*, *Macaca nemestrina*, *Trachypithecus obscurus*). Long-tailed macaques are very common in different areas of Malaysia (i.e., beaches, sea sides, tropical areas and tall bamboos) (Medway, 1983). Macaque's populations in Malaysia have not received much attention, as many researchers focus on ecology, behaviors and genetics (Md-Zain *et al.*, 2011a). The highest population density of *Macaca fascicularis* are surviving in Peninsular Malaysia.

Identification of *Macaca fascicularis*: the color of *Macaca fascicularis* is brown-gold and looks grey-black. The down part is brown-light, their feet, hand's palms and faces are colored looking similar as red meat and hairless. Its tail is longer than other macaques (Medway, 1983). But the tail may be shorten due to accident, it mostly happened in older animals (Adams *et al.*, 1985). The head length of long tailed macaques varies from

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place to place (Fooden and Albrecht, 1993).

This paper focuses on population census of *Macaca fascicularis* at different habitats of northern region in Peninsular Malaysia. This species can be easily traced any time of the year and day for data collection, as it can be easily observed around human's surroundings. The behaviors of this type of macaques are eye-catching and they exhibit different behaviors which were recorded during survey. Present study will increase the understanding of long tailed macaque's population in northern Peninsular Malaysia. The objectives of this paper are: to investigate and clarify the dominant species of three states of Peninsular Malaysia as well as to find out the declining species as the population is decreasing due to by the Human-macaques conflict (Suchinda and Hamada, 2008). The population study of macaques is essential as described by Md-Zain *et al.* (2011a). Because of conservation implications, it is necessary to find out the population census (Erin and Nancy, 2010).

METHODS

Study area

The data was collected from three northern states of Peninsular Malaysia, 1) Penang 2) Kedah and 3) Perak. The wild species are protected in many areas of Malaysia; there are jungles, tropical areas and gardens for the surveillance of macaques. Peninsular Malaysia is situated south of Thailand, north of Singapore and east of the Indonesian island (Sumatra). The country contains peat swamp timberlands, tropical rain forest with dipterocarp forests and mangrove forests (Mohd-Azlan, 2006).

Descriptions of study sites and their environmental conditions

Peninsular Malaysia is situated between 99° to 105° east and 1° to 7° north and covers an area of 131, 587km². It is composed of upland, tidal wave plain and shores zones (Wong *et al.*, 2009). The area where the study was conducted is next to hilly region and the lowland seaside. The climate of Peninsular Malaysia is warm and tropical humid all year around with temperatures range from 21°C to 32°C, as it is typical for a humid tropical climate.

The rainfall is considered by two rainy seasons associated with the Southwest Monsoon from May to September and the Northeast Monsoon from November to March (Suhaila and Jemain, 2009).

The data was randomly collected at ten different habitat in three states of northern Peninsular Malaysia: 1) Cherok To'kun Penang: Situated in eastern of Bukit Mertajam (BM) Province located in the mainland of Penang state (N 05° 21.522", E 100° 29.606"). It has few exciting sites as mountain climbing and joking tracks near the To'kun Dam which name "Hutan Lipur". 2) Bukit Juru Penang: (N 05° 20.055" E 100° 24.457") it is natural land structures with huge amount of deep canopy. Bukit Juru is located in North South of Bukit Martajam Penang, Malaysia. 3) Botanical Gardens Penang: (N 05° 26.265" E 100° 17.437") This Gardens is situated on Jalan Air Terjun, George Town on Penang Island, Malaysia. The Gardens is adjacent to the forest. The reserved area of the Gardens is around 14 hectors. 4) Seberang Jaya Penang: (N 05° 23.247", E 100° 24.773") Seberang Jaya is a new township near Butterworth, Penang, Malaysia. The research area was beside the hypermarket "Carrefour". The area is composed of on stream, rubbish side and trees. 5) Bukit Selambau Kedah: (N 05° 39.509", E 100° 33.807") Bukit Selambau is a small settlement in Kedah, Malaysia. It is situated around 18 km from Sungai Petani city. The area is composed of villages and dense forests. 6) Gunung Jerai Kedah: (N 05° 49.716", E 100° 27.517") Gunung Jerai Kedah or previously Kedah Peak is the uppermost mountain in the Malaysian state of Kedah with the height of 986 meters (3,235 feet). 7) Pulau Burak, Kedah: (N 06° 22.719", E 099° 40.415") it is situated in Langkawi, as Island of Kedah, Malaysia. Most of the part of this area is primary forest; it is also surrounded by the mangrove forest. 8) Guar Kelawar Kedah: (N 06° 24.307" E 099° 51.499") it is suited adjacent to the famous visiting spot of Langkawi Sky Bridge. It has primary forests, Waterfall and recreational parks. 9) Taiping Zoo Perak: (N 04° 51.285", E 100° 44.989") Zoo Taiping is a zoological Gardens located at Bukit Larut, Taiping, Perak, Malaysia. It is the oldest Zoo in Malaysia. Zoo Taiping covers 34 acres area. 10) Pondok Tanjung Perak: (N 05° 02.101", E 100° 43.679") it is composed of on highway and

agricultural farms with palm oil trees, rubber trees and natural forests (Fig. 1).

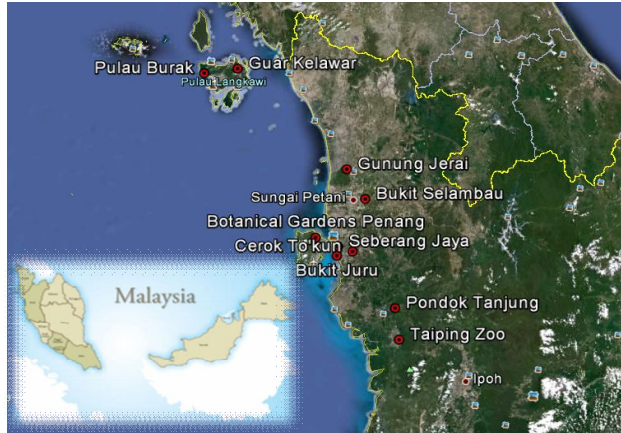


Fig. 1. A satellite map of the study area, showing location of ten selected study sites in northern region of Peninsular Malaysia (Modified from Google Earth).

Study subject

The data was collected for three species of macaques, viz., *Macaca fascicularis*, *Macaca nemestrina* and *Trachypithecus obscurus*. As, these species were visible in most of the areas. The long tailed macaques habitually coming down to human activities areas for searching of food. The possibility of counting both of the species *Macaca fascicularis* and *Macaca nemestrina* were increase. *Macaca fascicularis* and *Macaca nemestrina* were found the human activities areas (i.e., taking food and exhibiting different behaviors). *Trachypithecus obscurus* rarely come down; and are normally an arboreal species (i.e., they spent most of their time in trees).

Field techniques and population survey

Sampling could be of two types; 1. Scan sampling: It is a type of sampling in which state of behavior of all visible individuals of a group is specified within a specific period of time. (Scan sampling in Altmann's 1974 terminology). 2. Focal sampling: It is a type of sampling, in which the observer records the activity of an individual in a group at a preselected time (Fragaszy *et al.*, 1992). Scan sampling survey technique was used in present study. Observer was waiting in different bends of

the jungle for the visibility of macaques and quite slowly with gentle walking in the area where there were chances of visibility of macaques (Cooper, 2000). Sometime the observer was waiting at the side of the jungle for macaques to come out because of thick canopy as it was difficult to enter to the jungle. The inside deep jungle observations were not as satisfactory as observed in alone tree or on the open ground. The observer used to stay around the fruiting trees and rubbish side as the monkeys disperse the garbage most of the time. The data was collected as the observer censuses by counting the whole group as well as the individual available or visible during survey as the data was taken instantaneous recording in the field (Altmann, 1974).

The study was continued from November 2011 until May 2012. The observer used to work from 7am to 7pm, scan sampling method was used to observe the population. Most of the troops were visible early in the morning or late evening. All the possibilities were carried out to identify, count and observe the monkeys accurately. The visibility of one or two monkeys could clue that the troop is around.

Population size

This paper assessed the population size of three species of monkeys: *Macaca fascicularis*, *Macaca nemestrina* and *Trachypithecus obscurus*. The observer thoroughly counted the individual and groups of all the three species throughout the study. The total population size was estimated from all the observed monkeys.

The groups were further divided by five categories of age/sex classes as Adult male: Sexually and socially mature males, with well-developed secondary sexual characteristics (Sri *et al.*, 1997). Adult female: Sexually and socially mature females, with well-developed secondary sexual characteristics and Females with infant or given birth (Sri *et al.*, 1997). Sub-adult: Sub-adults have significantly less mating behaviors than adults and they include in low-ranking members of the group (Carol and McMillan, 1989). Juvenile: Sexually immature members of the group, difficult to distinguish their sex (Hamada and Aye, 2009). Infant: Infants with white and black pelage. These

members are mostly found hanging to adult female (Hamada and Aye, 2009).

Ethical consideration

The author used the Universiti Sains Malaysia's guideline for ethical consideration.

Statistical analysis

The data was entered to Microsoft Excel, percentages and frequencies were calculated among different ages/sexes classes with the use of axle tables in Microsoft excel. Sex proportion was taken in Microsoft excel then the data was transferred to SPSS (Statistical Package for Social Sciences). One-Way Anova test was used to find out the variation among species. The significant value for the finding was fixed as 0.05 ($p < 0.05$). Statistical package for social sciences version 19 was used for the analysis of variables.

RESULTS

The study counted the population of three species, percentages, frequencies, age/sex difference and probability is given in figures and tables. Total populations of three species were observed 508 individuals in 23 groups in Penang, Kedah and Perak. The average group size observed 22 individuals per group.

During this study it was found the population of *Macaca fascicularis* is the dominant species of three states of Peninsular Malaysia. *Macaca fascicularis* is 69%, *Trachypithecus obscurus* is 23%, and *Macaca nemestrina* is 8%

The frequencies and standard error was estimated by using SPSS descriptive analysis and figure was taken in Microsoft Excel as means and standard error (Fig. 2). Total number of *Macaca fascicularis* were 352 individuals, out of which 20 were infants (5.7%), juveniles 132 (37.5%), sub-adults 71 (20.2%), adult females 79 (22.4%) and adult males 50 (14.2%) were observed in this survey. *Trachypithecus obscurus* were counted as 118 individuals of which 3 (2.5%) were infants, 42 (35.5%) were juveniles, 17 (14.4%) were sub-adults, 35 (29.7%) were adult females and 21 (17.8%) were adult males. *Macaca nemestrina* were counted 38 individuals, of which 2 (5.3%) were infants, 16

(42.1%) juveniles, 4 (10.5%) sub-adults, 10 (26.3%) adult females and 6 (15.8%) adult males.

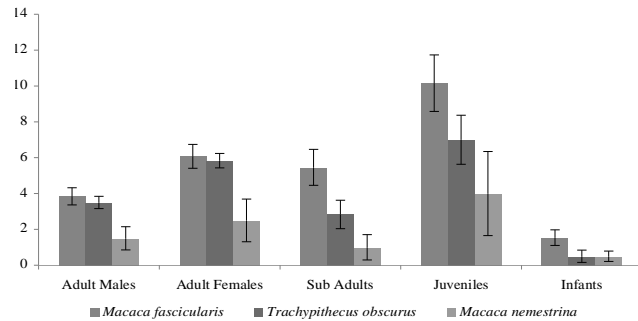


Fig. 2. Number (Mean ± SEM) of three species of monkeys in Peninsular Malaysia

Table I shows the co-ordinates of the study locations along with the individuals number and estimated number of troops. As in CheroK To kun Penang total three groups were observed, Bukit Juru Penang two groups, Botanical Gardens Penang three, Sabrang Jaya Penang two, Bukit Selambau Kedah one, Gunung Jerai Kedah three, Pulau Burak Kedah two, Guar Kelawar Kedah one, Taiping Zoo Perak three and in Pondok Tanjung Perak three troops. Total individuals were 508 and total groups 23.

The females:males ratio was 1.6:1 for *Macaca fascicularis*, and 1.7:1 for *Macaca nemestrina* and *Trachypithecus obscurus* (Table II).

Adult males presented the significant difference between two species *Macaca fascicularis* and *Macaca nemestrina* with $p < 0.01$). The mean for adult males were 3.35 and standard deviation 1.67. Adult females, sub-adults and juveniles were found significant for the above both species and $p < 0.008$, $p < 0.01$ and $p < 0.04$ respectively. The infants were found non-significant and *Trachypithecus obscurus* also showed no variation with both of the species (Table III).

DISCUSSION

The present survey found population of three macaque's species as 508 individuals in Peninsular Malaysia. Three species (*i.e.*, *Macaca fascicularis*, *Macaca nemestrina* and *Trachypithecus obscurus*) that were habituated with human and existing in






Table I.- Names and geographical coordinates taken, using the Global Positioning System (GPS) for three species of macaques found in Peninsular Malaysia

Location	GPS (N,E)	Species	Number counted (%)	Estimated no of troop
Cherok Tokun	N 05 21.522	<i>Macaca fascicularis</i>	33 (94.3%)	2
Penang	E 100 29.606	<i>Trachypithecus obscurus</i>	0 (0%)	0
		<i>Macaca nemestrina</i>	2 (5.7%)	1
Bukit Juru	N 05 20.055	<i>Macaca fascicularis</i>	20 (44.4%)	1
Penang	E 100 24.457	<i>Trachypithecus obscurus</i>	25 (55.6%)	1
		<i>Macaca nemestrina</i>	0 (0%)	0
Botanical Gardens	N 05 26.265	<i>Macaca fascicularis</i>	42 (73.7%)	2
Penang	E 100 17.437	<i>Trachypithecus obscurus</i>	15 (26.3%)	1
		<i>Macaca nemestrina</i>	0 (0%)	0
Seberang Jaya	N 05 23.247	<i>Macaca fascicularis</i>	38 (97.4%)	1
Penang	E 100 24.773	<i>Trachypithecus obscurus</i>	0 (0%)	0
		<i>Macaca nemestrina</i>	1 (2.6%)	1
Bukit Selambau	N 05 39.509	<i>Macaca fascicularis</i>	40 (100%)	1
Kedah	E 100 33.807	<i>Trachypithecus obscurus</i>	0 (0%)	0
		<i>Macaca nemestrina</i>	0 (0%)	0
Gunung Jerai	N 05 49.716	<i>Macaca fascicularis</i>	44 (78.6%)	2
Kedah	E 100 27.517	<i>Trachypithecus obscurus</i>	12 (21.4%)	1
		<i>Macaca nemestrina</i>	0 (0%)	0
Pulau Burak	N 06 22.719	<i>Macaca fascicularis</i>	39 (58.2%)	1
Kedah	E 099 40.415	<i>Trachypithecus obscurus</i>	28 (41.8%)	1
		<i>Macaca nemestrina</i>	0 (0%)	0
Guar Kelawar	N 06 24.307	<i>Macaca fascicularis</i>	12 (100%)	1
Kedah	E 099 51.499	<i>Trachypithecus obscurus</i>	0 (0%)	0
		<i>Macaca nemestrina</i>	0 (0%)	0
Taiping Zoo	N 04 51.285	<i>Macaca fascicularis</i>	26 (39.4%)	1
Perak	E 100 44.989	<i>Trachypithecus obscurus</i>	24 (36.4%)	1
		<i>Macaca nemestrina</i>	16 (24.2%)	1
Pondok Tanjung	N 05 02.101	<i>Macaca fascicularis</i>	58 (63.7%)	1
Perak	E 100 43.679	<i>Trachypithecus obscurus</i>	14 (15.4%)	1
		<i>Macaca nemestrina</i>	19 (20.9%)	1
Total			508	23

Table II.- Sex proportion of population.

Location	Sex Composition (♂ vs ♀ Ratio)		
	<i>Macaca fascicularis</i> Ratio	<i>Trachypithecus obscurus</i> Ratio	<i>Macaca nemestrina</i> Ratio
Cherok Tekon (Penang)	5:7	0	0:1
Bukit Juru (Penang)	3:5	2:3	0
Botanical Gardens (Penang)	1:2	3:5	0
Seberang Jaya (Penang)	4:7	0	1:0
Bukit Selambau (Kedah)	3:4	0	0
Gunung Jerai (Kedah)	8:13	3:5	0
Pulau Burak Langkawi (Kedah)	3:4	3:7	0
Guar Kelawar Langkawi (Kedah)	3:5	0	0
Taiping Zoo (Perak)	3:5	5:7	3:4
Pondok Tanjung (Perak)	7:11	3:5	2:5
Total	1:1.6	1:1.7	1:1.7

Table III.- Statistical test, Comparison of *Macaca fascicularis* population with *Macaca nemestrina* and *Trachypithecus obscurus*.

Age/Sex	Species	Means	Std Deviation	P-value*	
Adult males	<i>M.fascicularis</i> 	<i>Macaca nemestrina</i>	3.3478	1.66812	0.012*
		<i>Trachypithecus obscurus</i>			0.642
Adult females	<i>M.fascicularis</i> 	<i>Macaca nemestrina</i>	5.3913	2.44464	0.008*
		<i>Trachypithecus obscurus</i>			0.819
Sub-adults	<i>M.fascicularis</i> 	<i>Macaca nemestrina</i>	4.0000	3.39786	0.018*
		<i>Trachypithecus obscurus</i>			0.093
Juveniles	<i>M.fascicularis</i> 	<i>Macaca nemestrina</i>	8.2609	5.38700	0.046*
		<i>Trachypithecus obscurus</i>			0.220
Infants	<i>M.fascicularis</i> 	<i>Macaca nemestrina</i>	1.0870	1.34547	0.177
		<i>Trachypithecus obscurus</i>			0.121

One-Way ANOVA*

human made environment as accurately counted during survey. Present study investigated that the population of long-tailed macaques were in abundance and exhibited everywhere in Peninsular Malaysia. As reported by Yanuar *et al.* (2009), these three species are free ranging and have a suitable environment provided for their surveillance. These macaques have more members in the troop with the ratio of more females in the troops. Furthermore, these macaques are often exhibit closed to human settlement as food is simply obtainable and therefore they are giving responsiveness to human activities (Sha *et al.*, 2009). The average group size of these macaques was calculated as 22 individuals per group in this study, the result has close proximity with the previous research that the macaques group composed up 24 individual per group in Peninsular Malaysia (Southwick and Cadigan, 1972).

The observation showed that these macaques prefer to exist in a large group for the purpose of safety and food availability. Subsequently they have learned to associate with food and human. Present study revealed the sex proportion of females was 0.7 time higher than males. This agrees with finding of most of the primates (Karimullah and Shahrul, 2011).

The result assessed that there are higher significant difference between the population of *Macaca fascicularis* and *Macaca nemestrina* males $p < 0.01$, females $p < 0.008$, sub-adults $p < 0.01$ and juveniles $p < 0.04$. The population of *Macaca nemestrina* is very less compared to *Macaca fascicularis*. It is also shown that the percentage of *Macaca fascicularis* is higher than *Trachypithecus obscurus* (Fig. 2). This is comparable with previous research as described that the species of *Macaca fascicularis* is wide spread in Southeast Asia (Eudey, 2008).

In conclusion, *Macaca fascicularis* is the dominant species in terms of population density and group size in northern states of Peninsular Malaysia. It has been determined that the species of *Macaca nemestrina* is decreasing in most of the areas of Peninsular Malaysia. It has been proven that there is no population variation between *Macaca fascicularis* and *Trachypithecus obscurus*. According to the present study therefore, the population of *Trachypithecus obscurus* is stable species of Peninsular Malaysia.

Limitation of the study

The study results maybe limited due to less observation inside the jungle, because the author

was not able to move inside into a multistoried tropical forest.

Future study

It is recommended that study on these three species be conducted in future on larger landscape trans-boundary to exactly locate their distribution and habitat preference.

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