DAILY ACTIVITY BUDGET OF LONG-TAILED MACAQUE (*Macaca fascicularis*) AT RESIDENTIAL AREA (PIONER COVE), PORT DICKSON, NEGERI SEMBILAN PENINSULAR OF MALAYSIA

by

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DECLARATION

I am here to declare that the work includes in this report titled "Daily Activity Budget Long-Tailed Macaque (*Macaca fascicularis*) In Residential Area (Pioner Cove), Port Dickson, Nine States of Peninsula Malaysia" is the result of original research except as mentioned in the reference and not submitted simultaneously in the nomination of any other degree.

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ABSTRACT

The study investigates the daily activities of the long-tailed macaque (*Macaca fascicularis*) in Pioner Cove, Negeri Sembilan, over a 20-day period. A total of 346 instances of active behavior were recorded, emphasizing the macaques' structured daily routine. The macaques typically depart the forest at 8:20 a.m. to forage and engage in social activities, returning by 10:20 a.m. as temperatures rise. They resume their foraging in the afternoon, leaving again at 3:00 p.m. and returning at 6:30 p.m. Morning activities are particularly beneficial, as they reduce the risk of predator encounters, which are more likely in the afternoon heat.

The most frequently observed behaviors included play (15.42%), vocalization (14.86%), and grooming, (14.07%) with additional activities such as eating, resting, and maternal care noted. The findings highlight significant variations in activity frequency, contributing to the understanding of the social structure and adaptive behaviors of these primates. This research is crucial for developing effective conservation strategies and managing human-wildlife conflicts in areas where macaques and humans coexist

BAJET AKTIVITI HARIAN KERA EKOR PANJANG MACAQUE (*Macaca Fascicularis*) DI KAWASAN KEDIAMAN (PIONER COVE), PORT DICKSON, SEMBILAN NEGERI SEMENANJUNG MALAYSIA

ABSTRAK

Kajian itu menyiasat aktiviti harian kera ekor panjang (*Macaca Fascicularis*) di Pioner Cove, Negeri Sembilan, dalam tempoh 20 hari. Sebanyak 346 contoh tingkah laku aktif telah direkodkan, menekankan rutin harian berstruktur kera.

Kera biasanya berlepas dari hutan pada 8:20 pagi untuk mencari makanan dan terlibat dalam aktiviti sosial, kembali pada 10:20 pagi apabila suhu meningkat. Mereka menyambung semula mencari makan pada sebelah petang, bertolak semula pada 3:00 petang dan kembali pada 6:30 petang. Aktiviti pagi amat berfaedah, kerana ia mengurangkan risiko pertemuan pemangsa, yang lebih berkemungkinan berlaku pada waktu petang.

Tingkah laku yang paling kerap diperhatikan termasuk bermain (15.42%), penyuaraan (14.86%), dan dandanan (14.07%), dengan aktiviti tambahan seperti makan, berehat, dan penjagaan ibu diperhatikan. Penemuan ini menyerlahkan variasi ketara dalam kekerapan aktiviti, menyumbang kepada pemahaman struktur sosial dan tingkah laku penyesuaian primata ini. Penyelidikan ini penting untuk membangunkan strategi pemuliharaan yang berkesan dan menguruskan konflik manusia-hidupan liar di kawasan di mana kera dan manusia wujud bersama.

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LIST OF ABBREVIATIONS

FD	Feeding
GR	Grooming
IA	In Active
MV	Moving
MT	Mothering
PL	Playing
RT	Resting
VL	Vocalization

LIST OF SYMBOLS

%	Percentage
chi^2	chi squared
O i	observed value
E i	expected value

CHAPTER 1

INTRODUCTION

1.1 Background of Study

There has been a dramatic shift in Southeast Asia, with formerly wooded regions rapidly being transformed into urban centers and agricultural plantations, with a focus on oil palm plantations. Macaques have been forced to forage in nearby forests and human settlements due to the destruction of their native habitats (Fuentes et al., 2005; Gumert etal., 2011; Sha et al., 2009; Hambali et al., 2012). *Macaca fascicularis* have gotten into fights with locals as a consequence of their curiosity in the neighbour hood. The presence of these animals, sometimes known as feral animals, is a major problem in many areas, including cities, towns, roads, farms, neighbour hoods, churches, and hotels. Both apes and baboons pose a threat to people in Asia and Africa due to their widespread distribution and similar resource needs (Hill, 2000; Priston, 2005).

The pelage of the long-tailed macaque subspecies exhibits a variety of colours, including white and light buff on the ventral side, and light to medium olive dark brown on the dorsal side. According to Fooden (1995), museum specimens of adult males often exhibit dorsal pelage that varies in coloration, ranging from buffy to yellowish grey, golden brown, reddish brown, and even blackish. The subspecies *Macaca fascicularis* philippinensis, native to the Philippines, has been shown to possess a uniformly black pelage (Fooden, 1991). According to Hamada et al. (2005), several individuals within the *Macaca fascicularis* population in Thailand have an atypical pale yellowish fur coloration.

According to Fooden (1995), although some museum specimens exhibit a darker crown in comparison to the dorsal pelage, it is often observed that the crown tends to possess a lighter hue than the back. According to Fooden (1995), several subspecies have an asymmetrical tuft or crest composed of feathers located on the upper part of the head. Furthermore, apart from the ventral surface of the limbs and tail, the pelage on the ventrumis characterised by its thinness and a colour ranging from grey to light-colored (Fooden, 1995). Various hues of face skin include tan, pink, and dark gray-tan. The eyelids are often used in facial communication due to their more vibrant coloration. Women may be distinguished from men by the presence of light grey facial hair that has resemblance to a beard. The phenotypic variations seen across different subspecies of long-tailed macaques may be mostly attributed to subtle differences in pelage colour andpatterning, however it should be noted that not all variances can be accounted for by these factors. The phenotypic characteristics of long-tailed macaques exhibit variations among subspecies, as well as differences in body size and limb proportions throughouttheir geographical distribution.

The relationship proposed by Bergman's rule, which posits that there is a positive correlation between body size and decreasing temperature as well as rising latitude, seemsto be substantiated by the observed pattern of variation (Fooden & Albrecht, 1993). According to Fooden and Albrecht (1993) conducted a study that revealed a positive link between increasing latitude and the enlargement of skull size. According to the authors of the research, the discovered pattern exhibits greater prominence in regions located south of the equator as compared to those situated north of it. Moreover, the findings of the study suggest that thereis a discernible increase in the length of Bergmania skulls

across the latitudinal range of 13°N to 8°S. However, it is noteworthy that the observed variation in skull length within the northern portion of this range does not conform to Bergman's rule. Fooden and Albrecht (1999) observed a gradual change in the length of *Macaca fascicularis* has a tail that follows Allen's law. According to Allen's rule, the proportional length of a body's appendages would decrease as latitude increased and temperature decreased. *Macaca fascicularis* have gotteninto the habit of residing near human habitations because people are willing to feed them. As a consequence, they have begun to disrupt residential areas in quest of food that is discovered in garbage cans or residences. Moreover, the existence of human living areas surrounded by a lot of trees is one of the primary reasons of *Macaca fascicularis* presence in human places. *Macaca fascicularis* have also made a home among these trees as a resultof development's disruption and harm to their original environment. Because of the abundance of palm fruit and human food waste, monkeys are modifying their habits, such as preferring to sleep on the tree closest to human settlement (Kurland, 1973). The purposeof this study was to learn more about *Macaca fascicularis* daily activities in the residentialarea of Pilot Cove, Negeri Sembilan. These routine tasks are also completed in order to support the concerned parties in maintaining and controlling *Macaca fascicularis* within the study area.

1.2 Problem Statement

The study of *Macaca fascicularis* in areas lacking data to assist relevant parties in monitoring *Macaca fascicularis* in the residential area (Pioner Cove) Negeri Sembilan constitutes the problem statement. Because some people feed *Macaca fascicularis* until they get acclimated to humans, *Macaca fascicularis* is an animal that frequently causes disturbances to the local human population.

1.3 Objective

To identify the daily activities of *Macaca fascicularis* in Pioner Cove, Port Dickson, Negeri Sembilan.

1.4 Scope of Study

This research focuses on the everyday activities of *Macaca fascicularis* in Pioner Cove, using a residential area as the designated study location. The primary method used for data collection is direct observation. The use of smart phones and binoculars by students may effectively limit the level of engagement between the observer and the animal. The research incorporates a supplementary collection of visual data captured via the use of camera. The data would be used to construct an ethogram that captures the frequency of the activity at ten-minute intervals. *Macaca fascicularis* macaques engage in a range of everyday activities, including locomotion, foraging, social grooming, playful interactions, vocal communication, periods of rest, and maternal care.

1.5 Significant of Study

Pioner Cove in Negeri Sembilan, which is serving as the study location, is where observations of the behaviour *of Macaca fascicularis* are being made. The outcomes ofthe research could provide helpful insights and assistance to the authorities in their effortsto properly regulate and preserve *Macaca fascicularis*. In addition, the collectingof preliminary data serves the objective of preparing for future decision-making in the real of management.

CHAPTER 2

LITERITURE REVIEW

2.1 *Macaca fascicularis*

The Macaca genus is the predominant non-human monkey species found in Asian countries, specifically belonging to the subfamily Cercopithecinae. It is worth noting that the North African Barbary macaque (*M. sylvanus*) is the only macaque species found outside of Asia (Fooden, 2006). The macaques under consideration are found in a diverse range of habitats, such as coastal mangrove forests, lowland forests, and montane forests (Fooden, 2006). The ecosystems have a substantial impact on the nutritional variety of the in habitants.

The monkey family Cercopithecidae includes the long-tailed macaque *Macaca fascicularis*, which has a weight range of 3 to 5 kg (Lucas, 1995). *Macaca fascicularis* is categorised as a species of vulnerable on the Red List of the International Union for Conservation of Nature (IUCN) due to its wide geographical distribution, presumed substantial population size, ability to inhabit many habitats, and occurrence in several protected areas (Ong & Richardson, 2008).

2.2 Distribution

Troughly 18,000 years ago, at a period when sea levels were roughly 120 metres lower than their present levels, the migration of long-tailed macaques from the Asian peninsula to the Indonesian archipelago began. Asia is home to a total of ten subspecies of *Macaca fascicularis*, with a particular concentration in the Southeast Asian region. The macaque subspecies may be found in Brunei,

Cambodia, Indonesia (specifically Sumatra, Java, Kalimantan, Bali, Lombok, Sumbawa, Flores, Sumba, and Timor), Malaysia, the Philippines, Singapore, South Thailand, and southern Vietnam.

Kelimutu National Park (Taman Negara Kelimutu) is among the smaller national parks in Indonesia. The Taman Negara Kelimutu has a total land area of 5356.5 hectares. However, the level of biodiversity on flores island is very high. The long-tailed macaque is among the documented fauna species found in Kelimutu, Tennessee, which has been identifiedas a habitat for at least 70 such species. The Lesser Sunda area, including Bali, Lombok,West Nusa Tenggara, and East Nusa Tenggara, has a recent occurrence of long-tailed macaque populations, with flores island's Taman Negara Kelimutu serving as a notable example.

The probably because for the ocean's significant retreat of over 120 meters from the Lesser Sunda area and nearby islands around 18,000 years ago may be attributed to the migratory patterns of the long-tailed macaque originating from the Sunda Islands, including Java, Sumatra, and Kalimantan. Long-tailed macaques have the potential to persist and reproduce on Flores island, which constitutes a portion of Taman Negara Kelimutu. Thelocal inhabitants often designate these primates as Ro'a. Limited study has been conducted on long-tailed macaques in the specified region. Existing knowledge suggeststhat long-tailed macaque behaviour in Kelimutu, TN, mostly occurs within the forest and utilisation zones, according to Fauzi (2020).

2.3 Habitat

Long-tailed macaques, also called crab-eating macaques and cynomolgus monkeys, are found across South Asia. This includes the countries of Bangladesh, Brunei Darussalam, Cambodia, India (Nicobar Island), significant portions of Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Timor-Leste, and Vietnam.

Human habitation, mixed mangrove swamps, freshwater swamps, scrub grasslands, deciduous woods, evergreen forests, and bamboo forests are just some of the places you could see this species. Additionally, humans have transported it to a variety of countries outside of its native range, such as China and the island of Mauritius. Because of hybridization with the rhesus macaque *(Macaca mulatta)* in mainland southeast Asia, pinpointing the northern border of the long-tailed macaque species is difficult, according to Jennifer Botting, 2020.

2.4 Ecology of *Macaca fascicularis*

Macaca fascicularis, known for its ecological flexibility, exhibits a diverse dietary behaviour by consuming a wide range of food sources that are readily accessible within its ecosystem. The species' ecological flexibility enables them to successfully acclimatize to many environmental conditions. The ecological plasticity of a species may be inferred from its ability to adjust to many factors such as food type, breeding parameters, group size, and home range population. Prior studies have shown that the eating behaviour of *Macaca fascicularis* might varya cross different locations, depending on the environmental conditions. The *Macaca fascicularis* group, residing in close proximity to Natai Lengkuasin Central Kalimantan, has a predominant preference for fruit consumption, accounting for around 66.7% of their dietary intake. The utilisation of fake food

by the leading *Macaca fascicularis* team in Ubud, Bali, was found to be higher (58%) compared to the consumption of natural food. This discrepancy may be attributed to the tendency of both visitors and local vendors to provide a greater quantity of peanuts and sweet potatoes, which are artificial food sources, rather than natural food options, according to S. Julianti et al. 2020.

2.5 Behaviour

Due of their wide range, these animals' habits and lifestyles show variety in both urban and natural settings. In contrast, long-tailed macaques spend a large proportion of their daytime period engaged in movement (18-30%), foraging (16-24%), and resting (16- 20%) over a wide variety of habitats. Individuals in human-influenced environments may engage in fewer social interactions than those in unaffected environments, but they still engage in significant amounts of social behaviour, such as grooming, play, and sexual behaviours.

They are predominantly an arboreal species that sometimes forages for food in the open. Their ranges sometimes overlap with those of other primate species and they have been known to engage in aggressive encounters with other species. (Jennifer Botting. 2020)

2.6 The nutritional attributes of The *Macaca fascicularis*

A variety of ape species exhibit omnivorous dietary habits and play a significant role as primary eaters of plants (Wiafe, 2015). According to Curtin (2002), the primary component of the diet of roll way monkeys (*Cercopithecus diana roloway*), which belong to the Cercopithecidae family, consists mostly of fruits. These monkeys are often found in Ghana's Bia National Park. The nutritional analysis revealed that the pulp of fully developed fruits is the primary and most substantial dietary component for this specific species. The study conducted by Bourliere et al. (1970) revealed that Lowe's monkeys

(*Cercopithecus campbelli lowei*), who belong to the Cercopithecidae family, had a greater preference for consuming fruits in the Ivory Coast compared to flowers, leaves, or insects. Fruit consumption is a significant portion of the dietary intake of long-tailed macaquesresiding in Borneo, Kalimantan. In this region, mature and succulent fruits account for around 66.7% of the macaques' overall diet, whereas their counterparts in Sumatra exhibit a higher fruit consumption rate of 82% (Yeager, 1996; Wich et al., 2002). Duringtimes of reduced fruit availability, such as the transition from the dry season to the beginning of the rainy season, long-tailed macaques exhibit a shift in their dietary preferences towards other food sources. The dietary options include a variety of items such as insects, stems, both young and adult leaves, flowers, seeds, grass, mushrooms, invertebrates, bird eggs, clay, and bark (Wheatley, 1980; Yeager, 1996; Son, 2003). Long-tailed macaques exhibit a significant investment of time in the consumption of crabs during their foraging activities inside the mangrove forest. Additionally, empirical evidence has shown their consumption of other prey items such as frogs, prawns and squid, as documented by Sussman and Tattersall (1986) and Son (2003).

The influence of seasons and elevations on food sources has been observed, and previous studies have mostly focused on the eating ecology of long-tailed macaques inlowland areas (Ungar, 1996; Nila et al, 2014). Moreover, long-tailed macaques have a well define social structure within their social group, whereby individuals of higher social status are given priority access to preferred food resources. According to van Schaik and van Noordwijk (1988), the provision of fruit triggers intense interactions among group members, characterised by a high level of aggression. This behaviour maybe attributed to the strong competition that arises due to the significance of fruit as a vital food source. According to Sussman and Tattersall (1981), long-tailed macaques have acircular foraging pattern that is

influenced by factors such as the presence of food, resting spots, water supplies, and protective vegetation. Long-tailed macaques adopt a variety of eating strategies, including manual selection or the utilisation of their dentition to extract fruits, crushing stone by stomping, capturing insects in mid-air, and storing food in their buccalpouches (Sussman & Tattersall, 1981; Lucas & Corlett, 1998).

2.7 Mating System

This study lends credence to the theory that *Macaca fascicularis* engages in both polygamy and polyandry. An example of how a group's organisational structure affects its members' sexual conduct inside the group is provided by the mating system of long-tailed macaques. Both sexes of these animals engage in sexual activity with several partners, demonstrating their promiscuous mating habit. The majority of sexual interactions in monkey mating systems are initiated by alpha and beta males, even though females engage in mating with many more men than men. The data show that the benefits of female sexual partnership are equal to those of male monopoly. Since long-tailed macaque males are viewed in such high esteem, their sexual conduct tends towards displays of dominance. These findings are consistent with those found in Antje et al. (2006) investigation.

CHAPTER 3

MATERIALS AND METHOD

3.1 Study Area

For the study area or place, after research, Pioner Cove, Negeri Sembilan which coordinates (2°31'22.5"N 101°49'29.0"E), is a suitable place to conduct a study on *Macaca fascicularis*, considering the place that has many groups of monkeys.

Figure 3.1: The location sampling of daily activities *Macaca fascicularis*, Pioner Cove, Port Dickson, Negeri Sembilan

3.2 Materials

These are the resources that were utilized in the research to gather information regarding *Macaca fascicularis* daily activities in Pioner Cove, Port Dickson, Negeri Sembilan. The materials are shown in the following Table 3.2.1.

Table 3.2.1 materials used during observation

Material	Picture	Function
GPS 72H	 Source: Garmin GPS72H Sea	To ascertain the long-tailed macaque's coordinates
Binocular	 Source: Fujifilm Day/Night Binoculars	To better understandhow the long-tailedmacaque moves

Camera	 Source: Canon EOS RP Mirrorless Digital Camera	Capturing and documenting the behavior of long-tailed macaques

3.3 Data Analysis

The Chi-Square test is a statistical tool used to determine the relationship between two categorical variables. It compares observed frequencies with expected frequencies to assess the significance of the relationship. The test helps determine if variables are independent or correlated, and it is widely used in various fields such as biology, social science, quality control, and market research.

There are two main versions of the Chi-Square test: The Chi-Square Goodness-of-Fit Test, which checks if observed frequencies fit the expected distribution, and the Chi-Square Test for Independence, which determines if observed frequencies meet the anticipated distribution. The test also determines if the difference between observed and expected frequencies is statistically significant.

The Chi-Square test is applied in research studies to identify correlations and independence between categorical variables. The results can inform decisions in various fields, such as identifying trends in market research or understanding biological relationships. Overall, the Chi-Square test is a powerful tool for analyzing categorical data, providing insights into the relationships between variables and helping researchers and practitioners make informed decisions.

$$\chi^2 = \sum_i \frac{(O_i - E_i)^2}{E_i}$$

CHAPTER 4

RESULTS AND DISCUSSION

4.1 General Results of Observation

Table 4.1 Total calculation using Chi-Square for the daily activity of *Macaca fascicularis*

ACTIVITIES	IA	MV	FD	GR	PL	VL	RT	MT
OBSERVATION	346	222	388	430	471	454	384	360
EXPECTED	381.875	381.875	381.875	381.875	381.875	381.875	381.875	381.875
(O-E) ^2 / E	3.370254	66.93294	0.098241	6.064853	20.80007	13.62233	0.011825	1.253069

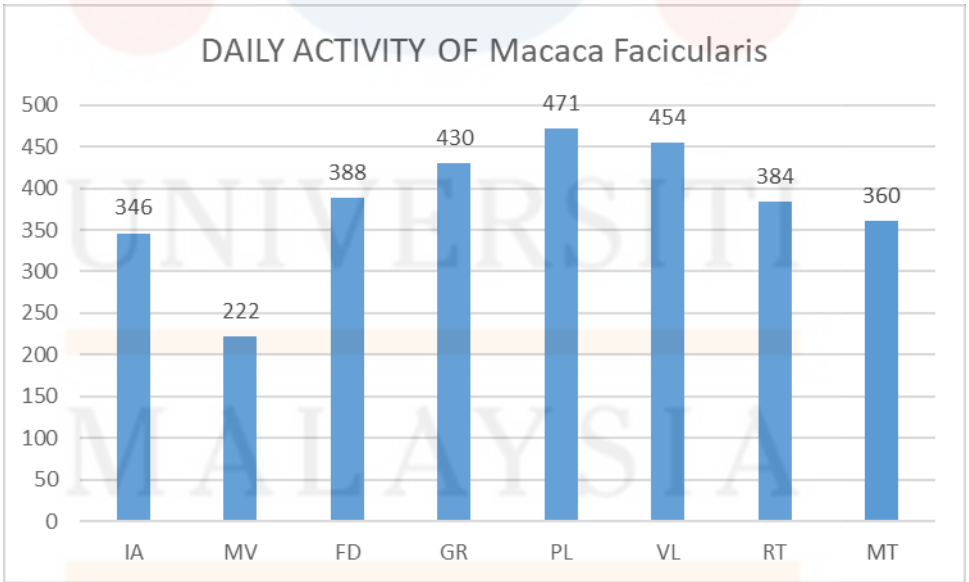

Figure:4.1 Daily Activity of *Macaca fascicularis*

The *Macaca fascirularis's* daily activities are displayed in the table. Twenty days were dedicated to this study, which took place in Port Dickson, Negeri Sembilan's Residential Area (Pioner Cove). The *M. fascicularis* activity times over

a 20-day period are displayed in the bar graph above. There are 346 instances in all that are listed in Active (IA). This is stated because *M. fascicularis* have a set time when they must depart the forest and go to different locations in order to play and find food. When the weather gets warmer, they will return to the forest at 1020 a.m. having left at 0820 a.m. in search of food. They begin to exit the forest in the evening at 1500 p.m. and return at 1830 p.m. In contrast to the sweltering afternoon, the morning offers milder and more comfortable temperatures. Engaging in morning activities can also lower the danger of predators. Long-tailed macaques have a better chance of finding food and moving around without being seriously threatened in the morning when some predators may be less active. Activity behavior in the morning can lessen the chance of being attacked by nocturnal or crepuscular predators, according to Altmann and Samuels (1992).

Moving (MV) has taken place 222 times overall. This is due to the fact that they only move to nearby locations where they can eat, rest, and play. As a result, they won't travel as much. There are 388 times in total that feeding (FD) occurs. Observations made about this *Macaca fascicularis* has a voracious appetite because it eats a wide range of foods, including fruits, tiny insects, leaves, and food that people have left behind. This illustrates the frequency with which *Macaca fascicularis* eats.

Furthermore, there's the Grooming (GR) activity. At 430 times, this activity has the third highest frequency of all the activities. This is said to be the case because *Macaca fascicularis* always performs this grooming task. Adult or juvenile *Macaca fascicularis* frequently engage in this activity. This is so that they can maintain their personal hygiene and indulgence as a couple or mother and child through grooming. The next activity is the playing activity (PL), which has the highest frequency of all the activities at 471. This is said to be the case because

Macaca fascicularis babies and teenagers are frequently observed playing together during these observations.

Furthermore, there is a vocalization (VL) activity with a 454-times frequency. This observation indicates that *Macaca fascicularis* sounds frequently. This is said to be the case because they argue or call a partner. The male *Macaca fascicularis* makes an aggressive sound when it is fighting. The next is that the frequency of resting activity (RT) is 384 times. This is said to be the case because, in contrast to teenagers or babies, adult *Macaca fascicularis* prefers to sleep. It's common to spot adult *Macaca facicularis* relaxing on tree branches. Mothering (MT), with a frequency of 360 times, comes last. The reason for this is that the mother is frequently observed nursing and petting her children. This frequency may suggest that the *M. fascicularis* belongs to an animal species with strong maternal traits.

Table 4.2: Percentage of *Macaca fascicularis* Behaviour

No.	Species Behaviours	Total Observations	Percentage
1	In Active (IA)	346	11.33%
2	Moving (MV)	222	7.27%
3	Feeding (FD)	388	12.70%
4	Grooming (GR)	430	14.07%
5	Playing (PL)	471	15.42%
6	Vocalization (VL)	454	14.86%
7	Resting (RT)	384	12.57%
8	Mothering (MT)	360	11.78%
9	Total	3055	100%

Table 4.2 shows the percentage of each activity performed by *Macaca*

fascicularis. Chi-squared equals 112.154 with 7 degrees of freedom. The two-tailed P value is less than 0.0001 by conventional criteria, this difference is considered to be extremely statistically significant. There are 8 activities performed by *Macaca fascicularis* on a daily basis, namely in active, moving, feeding, grooming, playing, vocalization, resting, and mothering.

Out of all the observations, the playing activity (PL) has the highest percentage of 15.42%. This assertion is based on the observation that *Macaca fascicularis* babies and teenagers frequently appeared to be playing in the downstairs area during the observation period. Long-tailed macaques, or *Macaca fascicularis*, play with one another frequently for a variety of reasons pertaining to their social structure, cognitive development, and general well-being. Playing with each other can help create and strengthen social bonds within the group, which is why *Macaca fascicularis* frequently engage in play to strengthen social bonds. Playing among themselves helps them build trusting bonds with other group members, which is advantageous in times of conflict or resource competition. According Van Schaik et al. (1983). Young *Macaca* can also pick up valuable skills that will help them as adults. These comprise cognitive abilities like problem-solving and social hierarchy comprehension, as well as motor skills like strength and coordination. Young *Macaca* can safely hone these skills through play without facing the dire repercussions that could occur in riskier circumstances. According Van Schaik et al. (1983).

At 14.86%, vocalization (VL) has the second-highest percentage. This behavior is common because *Macaca fascicularis* frequently produce noises when they fight, when someone is threatening them, and when they interact with one another. They also communicate with each other by making sounds. To alert other group members to danger such as intruders or predators they make loud,

recognizable calls. Members of their group will benefit from this sound by learning to be vigilant and protective. According by Jones-Engel et al. (2005). During the mating season, they also produce noises, which aid in calling their partners for mating activities. This call helps to coordinate reproductive behavior and attract mate. According by Machanda et al. (2013).

Grooming (GR) has the third-highest percentage at 14.07%. One of the primary activities that demonstrates the group's hierarchical structure is grooming. Gumert's (2007) research, which views grooming as an exchange to obtain access to the infant because it indicates a desire to care for young children other than oneself, supports this conclusion. Adult *Macaca fascicularis* animals of both sexes are typically observed grooming one another following a mating encounter. According to Gumert's (2007) study, grooming can be viewed as a post-intercourse reward for the partner. Higher-ranking women are typically accompanied by lower-ranking women. This behavior is intended to reduce disturbance during invasion, increase cooperation, and facilitate access to food during times of resource scarcity (Hambali et.al, 2012b). Macaques are a polygamous species, meaning that they have been seen to mate with multiple females.

With 12.70%, feeding activity (FD) has the fourth-highest percentage. The study area provides macaques with a wide variety of high-quality food sources, including oil palm plantations, human settlements, fruit orchards, and areas with a variety of fruit trees, including banana, rambutan, and nona. Food intake is therefore seen to be at its highest level. Due to its ease of access to food sources, *Macaca fascicularis* has some of the highest eating activities.

The reason *Macaca fascicularis's* resting activity (RT) score of 12.57% is due to the fact that they are frequently spotted in tree top areas during cool weather. During the survey period, resting ranked as the fifth most frequently observed

behavior. This result is consistent with that of Hambali et al. (2012), who found that macaques rested less after engaging in foraging-related behavior. Monkeys search for food only during the day, they have to put in more effort to eat in order to survive at night. Furthermore, this study demonstrates that men sleep longer than women, which is consistent with Fuentes et al. (2007)'s findings in Padang Tegal, Bali, Indonesia. Macaques typically live in multi-male, multi-female groups led by an alpha male, meaning that there are typically more females than males in the group. Due to their frequent interactions with other group members such as when caring for babies women are less likely to take a nap.

The percentage of mothering activities is 11.78%. Because adult female macaques perform the majority of this activity, it is performed less often. This is a result of the increased likelihood that adult female macaques will carry their young in the front of their bodies. In addition, the act of carrying their child will facilitate nursing and allow them to give their child caresses. Conversely, active has a maximum of 11.33%. They are said to have a set time to emerge from the forest, which explains why. They will exit the forest at 0820 a.m. and return at 1020 a.m., based on the observations that have been made. The morning temperature is milder and more comfortable than the sweltering afternoon one. Participating in activities in the morning can also lessen the threat of predators. Because some predators may be less active in the morning, long-tailed macaques have a better chance of finding food and moving around without facing significant threats. According to Altmann and Samuels (1992), engaging in activity behavior early in the morning can lessen the likelihood of being attacked by nocturnal or crepuscular predators. They depart in the evening at 1500 p.m. and arrive back at 1830p.m. They only venture outside to find food, relax, and have fun when the weather is not too hot.

Finally, moving (MV) has a percentage of 7.27%. This is said to be the case because they are said to sit in the immediate vicinity and move less after emerging from the forest. They would eat, rest, and play in this area as well. The findings of Md-Zain et al. (2010) and Hambali et al. (2012b), which show that macaques travel during the day to forage, corroborate this. Moreover, because mobile activity does not entirely align with human presence, researchers indirectly impact the percentage of mobile activity. Due to their diurnal nature, macaques spend the majority of the day moving from place to place in search of food. The figure 4.1 daily activity of *Macaca fascicularis* indicates that young monkeys move more than adult male monkeys do.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Research on *Macaca fascicularis* in Port Dickson, Negeri Sembilan, provides important insights into these primates' daily routines and social interactions. Their interactions and routines were thoroughly understood during the 20-day observation period.

With 15.42% of all recorded activities being played, playing was the most often observed activity. This high frequency highlights how crucial play is to macaque children's social and cognitive development. Baby monkeys learn vital survival skills, improve their motor abilities, and fortify their social bonds through play. Play activities foster group trust and cooperation, which is beneficial in conflict or resource competition.

There are 454 instances of vocalization (14.86%) and it is crucial to communication. Apes communicate in groups, warn of danger, and entice potential mates through vocalizations. These noises alert members to potential dangers and support group cohesion. Another significant behavior noted by (14.07%) is grooming. This is a socially bonding and stress-relieving activity in addition to being important for hygiene. Within the group, grooming supports the social hierarchy and camaraderie. Social advantages like access to progeny or chances for mating are frequently exchanged for these activities.

A total of 12.70% of observations were related to eating. Food sources abound in the study area, including fruits, insects, and leftover human food. The high frequency of eating behavior is partly explained by the variety in the diet.

12.57% of all activities are classified as rest. Resting in tree tops is a common sight for monkeys, especially in the cooler hours of the day. After foraging, it's critical to engage in restorative behavior to preserve energy and lower stress.

Female macaques exhibit a strong maternal instinct, as evidenced by the amount of maternal activity (11.78%) that was observed. They take a great deal of time to clean and nurse their young. A robust social structure focused on maternal care is indicated by the frequency of maternal activity. The term "less active behavior," which has a frequency of 11.33%, refers to times when monkeys are not as active. These times are typically in the warmer months or following periods of intense activity.

This behavior is critical for preserving energy and keeping predators away during times of vulnerability. The macaques were observed to move as much as 7.27% of the time, which suggests that they primarily did so in close proximity to their feeding and sleeping areas. This restricted movement minimizes exposure to potential threats and uses less energy. The statistical significance of the observed variation in activity frequency was demonstrated by the chi-squared test results ($p < 0.0001$). This demonstrates the validity of the noted behavioral patterns and their significance to *Macaca fascicularis* daily life.

In conclusion, this study provides a comprehensive overview of the daily activities of *Macaca fascicularis*, emphasizing the importance of play, vocalization, grooming, feeding, and rest. These activities are essential to their social structure, survival, and well-being. By understanding this behavior, we can appreciate the complexity of macaque communities and develop more effective conservation and management strategies.

5.2 Recommendations

Based on a comprehensive study of *Macaca fascicularis* in Port Dickson, some key insights and findings highlight the complex social behavior and daily activities of these primates. To ensure their well-being and promote effective conservation efforts there are several recommendations for the conservation of *Macaca fascicularis.* Ensuring abundant and diverse food sources, given the importance of a diverse diet, conservation efforts should focus on preserving and restoring natural food sources such as fruit trees and insect populations. In areas with human-macaque interactions, strategies to manage food provision and reduce reliance on human waste should be implemented to encourage natural foraging behaviour. In addition to providing resting and sheltering areas for *Macaca fascicularis*, resting is important for macaques to conserve energy and reduce stress. Ensuring the availability of safe resting areas, especially in treetops or secluded places, can help macaques feel safe. Conservation areas should be designed with sufficient natural shelters to protect macaques from predators and environmental stressors.

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APPENDIX A

7.1 *Macaca fascicularis* is waiting for food

7.42*Macaca fascicularis* is groominganother monkey