PEST BEHAVIOUR OF LONG TAILED MACAQUE (*Macaca fascicularis*) IN SEKOLAH MENENGAH KEBANGSAAN TINGGI PORT DICKSON, PORT DICKSON, NEGERI SEMBILAN, PENINSULAR MALAYSIA.

by

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A report submitted in fulfilment of the requirements for the degree of Bachelor of Applied Science (Natural Resources Science) with Honours

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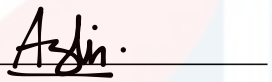
DECLARATION

I declare that this thesis entitled "Pest Behaviour of Long-tailed Macaque (*Macaca fascicularis*) in Sekolah Menengah Kebangsaan Tinggi Port Dickson, Port Dickson, Negeri Sembilan, Peninsular Malaysia" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

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Pest Behaviour of Long Tailed Macaque (*Macaca fascicularis*) **in Sekolah Menengah Kebangsaan Tinggi Port Dickson, Port Dickson, Negeri Sembilan, Peninsular Malaysia.**

ABSTRACT

Pest behaviour of long tailed macaque (*Macaca fascicularis*) have been researched in Sekolah Menengah Kebangsaan (SMK) Tinggi Port Dickson Negeri Sembilan, Peninsular Malaysia. The location of the study is concentrated in SMK Tinggi Port Dickson and observation of monkey pest behaviour was studied from 0800 and 1200 and 1500 and 1900 for six days a week for about 25 days. Intensive direct observation is done using the interval scan sampling method which is every 10 minutes. In addition, this study based on a questionnaire was conducted about knowledge, opinions, and human attitudes towards humans. Pest behaviour by monkeys the highest monitored was breaking into school area (37.17%), followed by messing up garbage cans (24.08%), damage facilities (16.75%), littering (16.49%), stealing (3.14%) and the lowest was disturbing people (2.36%). Basically, in total, 100 questionnaires were collected. This questionnaire has been spread randomly to the students of SMK Tinggi Port Dickson. The results showed that pest behaviour was related to the highest daily routine of invading the school area in search of food. This study is important to understand the behaviour of monkey pests in the area studies that can lead to pest management and species conservation on future. Therefore, the authorities need to take some action to reduce distractions. To solve local authority problems, school management and the Department of Wildlife and National Parks (DWNP) are necessary work together and find a solution. School management should seek help from local wildlife authorities or professional pest control services to humanely trap and relocate if problems persist.

Kelakuan Perosak Kera Ekor Panjang (*Macaca fascicularis*) **di Sekolah Menengah Kebangsaan Tinggi Port Dickson, Port Dickson, Negeri Sembilan, Semenanjung Malaysia.**

ABSTRAK

Tingkah laku perosak kera ekor Panjang (*Macaca fascicularis*) telah selidik di Sekolah Menengah Tinggi (SMK) Port Dickson Negeri Sembilan, Semenanjung Malaysia. Lokasi kajian adalah tertumpu di SMK Tinggi Port Dickson dan pemerhatian tingkah laku perosak kera telah dikaji dari jam 0800 and 1200 and 1500 and 1900 selama enam hari seminggu bagi kira-kira 25 hari. Intensif pemerhatian langsung dilakukan dengan menggunakan kaedah persampelan imbasan selang iaitu setiap 10 minit. Di samping itu, kajian ini berdasarkan borang soal selidik telah dijalankan tentang pengetahuan, pendapat, dan sikap manusia terhadap manusia. Kelakuan perosak oleh kera yang dipantau tertinggi adalah menceroboh kawasan sekolah (37.17%), diikuti oleh menyelongkar tong sampah (24.08%), merosakkan harta benda (16.75%), buang sampah merata tempat (16.49%), mencuri (3.14%) dan yang terendah adalah mengganggu orang (2.36%). Secara keseluruhan, 100 helai borang soal selidik telah dikumpul. Borang soal selidik ini telah tersebar secara rawak kepada pelajar-pelajar SMK Tinggi Port Dickson. Keputusan menunjukkan bahawa kelakuan perosak berkaitan dengan rutin harian paling tinggi iaitu menceroboh kawasan sekolah untuk mencari makanan. Kajian ini adalah penting untuk memahami kelakuan perosak kera di kawasan kajian yang boleh membawa kepada pengurusan perosak dan pemuliharaan spesies pada masa akan datang. Oleh itu, pihak berkuasa perlu mengambil beberapa tindakan untuk mengurangkan gangguan. Untuk menyelesaikan masalah pihak berkuasa tempatan, pengurusan sekolah dan Jabatan Hidupan Liar dan Taman Negara (PERHILITAN) perlu bekerjasama dan dapatkan penyelesaian. Pihak pengurusan sekolah perlu mendapatkan bantuan daripada pihak berkuasa hidupan liar tempatan atau perkhidmatan kawalan perosak profesional untuk memerangkap dan menempatkan semula secara berperikemanusiaan jika masalah berterusan.

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LIST OF ABREVIATIONS

SMK	Sekolah Menengah Kebangsaan
DWNP	Department of Wildlife and National Parks
PDR	People's Democratic Republic
kg	Kilogram
lb	Pound
ft	Feet
mm	Milimeter
m	Meter

LIST OF SYMBOLS

%	Percentage
X^2	Chi-square

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Known by its scientific name, *Macaca fascicularis*, the long-tailed macaque, is a monkey belonging to the "old world primate" family Cercopithecidae. The terms Macaca da Buffon, Java monkey, Kra monkey, Javoneraffe, and crab-eating macaque are further names for this long-tailed macaque. The name of this macaque comes from its physical attributes, such as its long tail and fondness for crabs. This species is known in Malaysia as the "kera" in Malay. The long-tailed macaque is distributed throughout Peninsular Malaysia, Sabah, and Sarawak, with a preference for lowland and coastal environments. According to Perhilitan (2006), these days, it is also easy to find them in cities. The Lesser Sunda Islands, Vietnam, Cambodia, Laos, Thailand, Sumatra, Jawa, Timor, Peninsular Malaysia, Philippines, Myanmar, Nicobar Islands, and Sumatra are among the countries where this species can be found, according to Hambali et al. (2012). The long-tailed macaque is a common species in Sabah, Sarawak, and the Peninsular Malaysian region. It favours mangroves, riverine forests, coastal forests, and primary lowland rainforests. Unexpectedly, it was discovered that macaques were more prevalent in metropolitan areas. Conflicts have arisen because of macaques' growing population in urban areas and their interactions with people (Sha et al., 2009).

Due to rapid population increase, there have been noticeable alterations to the long-tailed macaque's habitat. Humans may be to blame for the increase in conflict between humans and macaques by drastically altering the environment.

The difference between urban area and forest reserves has decreased because of these changes. Due to ecological changes, macaques are now wild in urban areas, creating an interface zone where humans and macaques can interact and where populations of both species are more closely spaced (Sha et al., 2009). As a result, this circumstance adequately explains the detrimental effectsthat this rivalry for resources has on both species.

Animals have undoubtedly migrated from forests to other habitats because of urbanisation. This gives macaques the freedom to alter their behaviour and engage in morehuman interaction (Sha et al., 2009). The rapid expansion of human civilization has not only resulted in the urbanisation of the world, but it has also disrupted the forest habitats oflong-tailed macaques. Conflicts between humans and primates have taken place as a result of the macaques being accustomed to humans and their food due to the accumulation of food waste from humans, food leftovers, or plantation crops around the macaques' new home (Hambali et al., 2012).

As a result, *Macaca facicularis* has infiltrated agricultural regions in quest of food, leading farmers to suffer losses because of the loss of its habitat and food supply. The species' subsequent acclimatisation and adaption to humans has also facilitated this invasion (Siex, 2005).

According to (Perhilitan, 2004), *Macaca fascicularis* has become a major problem in several states in Peninsular Malaysia, particularly those with fast growing populations like Johor and Selangor. According to Perhilitan (2006), estimates that there are between 116860 and 126470 *Macaca fascicularis* monkeys in groups that are causing problems, with the highest concentration in Johor at 32400 and the lowest in Perlis at 2550. Long-tailed macaques have become so

accustomed to humans that some have even established completely urban communities, living on the open rooftops of homes and stealing food from nearby trash cans (Perhilitan, 2006).

1.2 Problem Statement

There have been no documented observations or studies on the behavior of long-tailed macaques (*Macaca fascicularis*) and their interactions with humans at SMK Tinggi Port Dickson in Negeri Sembilan. However, there is a consistent pattern of conflictual behavior exhibited by the monkeys in this area. The presence of long-tailed macaques at SMK Tinggi Port Dickson has led to various issues, including property damage, potential risks to the safety of educators and students, and disruption of the normal functioning of educational facilities. Instances of misbehavior among the monkeys involve rummaging through trash cans and gaining access to classrooms and the administration building. This situation poses a threat to the overall safety and well-being of the school community.

1.3 Expected Outcome

The expected outcome of the study was to provide a more comprehensive comprehension of the behavior of the long-tailed macaque pest (*Macaca fascicularis*) in SMK Tinggi Port Dickson, Port Dickson, Negeri Sembilan. The questionnaire was intended to help the researcher gather more precise information about long - tailed macaques' (*Macaca fascicularis*) pest behavior. Furthermore, knowing the long - tailed macaque's (*Macaca fascicularis*) pest behavior was expected to lessen conflicts and issues between humans and macaques.

1.4 Objectives

The main objective is:

i. To determine the pest behaviour of long-tailed macaques (*Macaca fascicularis*) in Sekolah Menengah Kebangsaan (SMK) Tinggi Port Dickson, Port Dickson, Negeri Sembilan, Peninsular Malaysia.

ii. To study the human perception on human macaque conflict of long-tailed macaques (*Macaca fascicularis*) in Sekolah Menengah Kebangsaan (SMK) Tinggi Port Dickson, Port Dickson, Negeri Sembilan, Peninsular Malaysia.

1.5 Scope of Study

The purpose of this study is to determine the long-tailed macaques' pest behaviour at SMK Tinggi Port Dickson in Port Dickson, Negeri Sembilan. For instance, messing up garbage cans, littering, disturbing people, stealing, breaking into school area, and causing damage to facilities. Both direct observation and questionnaire surveys were used in this research. Teachers and students both received the survey questionnaire. Furthermore, a collection of views, beliefs, understandings, and dispositions on the long-tailed macaque (*Macaca fascicularis*) was made by educators and students. To evaluate the data and bolster the study data, data analysis techniques such as Chi-square (X^2) was used.

1.6 Significant of Study

As far as we know, no observations or investigations into the pest behaviour of long- tailed macaques (*Macaca fascicularis*) have been conducted at SMK Tinggi Port Dicksonin Port Dickson, Negeri Sembilan. Furthermore, there are numerous reports in the study region concerning the pest behaviour of long-tailed macaques (*Macaca fascicularis*). Preliminary data related to the pest behavior of long-tailed macaque (*Macaca fascicularis*) is very necessary to help management reduce the disturbance process. It can be used as a reference by other researchers to understand the long-tailed macaque's pestilential behaviour.

CHAPTER 2

LITERATURE REVIEW

2.1 Long-tailed Macaques

2.1.1 Morphology

According to Liedigk et al. (2015), the subspecies of long-tailed macaques undergo color changes, with the back, legs, and arms changing from light black or greyish to deepercolors. The lower portion of their bodies remains slightly lighter. Their heads are shaded and have a dark pinkish look, with a hair peak located at the top of the head. While female long-tailed macaques have facial hair and additional cheek stubbles, male faces are rimmedwith cheek bristles and feature thin, black moustaches. The eyelids near the snout of long-tailed macaques, both male and female, are white in hue. These macaques are named using the trademarks of this species in accordance with their trademark characterization.

Their characteristic feature is their remarkably elongated tail, which spans from 400 to 655 mm (1.31 to 2.15 ft) in length and is nearly invariably longer than their height from head to rump (Groves, 2001). Newborns have a black natal coat, which eventuallytransforms into adult pelage as they grow larger (Rowe, 1996). They start to lose their blackcoat at the age of two to three months, and by the time they are a year old, they have growninto adult colors (Fooden, 1995). Long-tailed macaques exhibit sex variation like other macaques (Dittus, 2004). Male body weights normally range from 4.7 to 8.3 kg (10.4 to 18.3 lb) and their measurements fall between 412 and 648 mm

(1.35 and 2.13 ft). Females weight between 2.5 and 5.7 kg (5.5 and 12.6 lb) on average, and their measurements range from 385 to 503 mm (1.26 to 1.74 ft) (Fooden, 1995). Compared to females, men have noticeably larger canine teeth, in addition to being heavier and taller (Dittus, 2004). Macaques carry food from the foraging location to their cheek pouches, where they can store it until they areready to eat (Lucas & Corlett, 1998).

2.1.2 Ecology

According to Wheatley (1980) stated that long-tailed macaques are naturally adapted to riverine and coastal environments, such as mangrove and gallery forests. They eat fish, prawns, clams,and crabs in addition to their main diet of fruits and seeds, despite what their common moniker, "crab-eating macaque," implies (Yeager, 1996). They can swim and dive (Wheatley, 1980).

Fruit is the main food source for long-tailed macaques (Yeager, 1996; Wich et al., 2002).When fruits are scarce, long-tailed macaques concentrate on eating insects, roots, new growing leaves, flowers, seeds, grasses, mushrooms, microorganisms bird eggs, clay, and bark.This occurs from the end of the dry season to the start of the rainy season (Wheatley, 1980; Yeager, 1996). Long-tailed macaques graze mostly on crabs when they forage in mangrove forests, although they have additionally been seen consuming prawns, squid, and frogs (Son, 2003). Seasons and altitude can affect their food sources, and lowland areas have been the main sites where the eating ecology of long-tailed macaques has been studied. Moreover, long-tailed macaques have a well-established social structure within their group, with higher ranked members

having first dibs on favored food items. When consuming fruit, group members engage most aggressively, suggesting fierce rivalry for this limited supply of food (Van Schaik & Van Noordwijk, 1988). When foraging, long-tailed macaques travel in circles; their routes differ depending on the availability of water, the locations of feeding places, rest areas, and protectivefoliage cover (Sussman & Tattersall, 1981). Long-tailed macaques adopt a variety of eating techniques, such as rolling over pebbles, catching insects in the environment, and keeping foods in their cheek pouches (Lucas & Corlett, 1998).

According to Van Schaik et al. (1996), the riverbank trees serve as roosting places for long-tailed macaques, who are picky about where they sleep. They cuddle up to keep warm asthey sleep to preserve body warmth. Each group has its own tree. They notably like to sleep onbranches that hang over rivers, and they prefer to doze close to the edge of the branches that are nearest to the top, or the tree's crown. Being proficient swimmers, long-tailed macaques may use this ability to elude predators by diving into the water and swimming to safety if theyfeel threatened (Rowe, 1996; Van Schaik et al., 1996).

2.1.3 Habitat

The extremely adaptive subspecies can be found in a wide range of habitats, such as main and secondary forest types, the mangrove forests, swamp forests, and places impacted byagriculture and human habitation around forests (Fooden et al.,1995). They spend most of theday perched atop trees, only coming down to feed. According to reports, the subspecies can befound as high as 1,800 meters in the Philippines and as high as 1,000 meters in Java, Borneo, and Sumatra (Heaney et al., 1998). It usually happens at lower elevations on the continent; in Thailand, it can reach as high as 700 m. Their home ranges can

span several hundred acres andare somewhat erratic. The monkeys can walk as far as two km per day, depending on the size of the group.

2.1.4 Reproduction

The availability of food, its high abundance over time, the fact that births happen earlierand more frequently in years with abundant food, and the higher birth rates in some years thatexceed years with mast fruiting than in years with average fruit availability all impact the success of a female's reproductive system (Van Schaik et al., 1987). Females reach sexual maturity at age four. While females with slightly damaged reproductive systems begin reproducing after five years of age, males reach sexual maturity by the age of seven. Before the age of five, daughters with healthy reproductive systems begin to procreate. The "copulation calls" are a specific set of vocalizations used by females during 80% of copulations.

During the reproductive season, female long-tailed macaques often mate with their partner several times a day. According to Van Schaik et al. (1988), females give birth to singletons and typically wait 18 months between pregnancies. Females are also more likely tohold off on having children for a year following giving birth. The reproductive potential of female macaques peaks at age 10, and they continue to procreate until age 24, however after age 20 there is a marked decline in reproduction.

2.2 Pest Behaviour of Long-Tailed Macaques

According to Md-Zain et al. (2004) identified six types of pest behaviour, which are consistent withprior studies and include damaging facilities, scuffing up garbage cans, littering, bothering people, stealing, and breaking into human areas. Any violent behaviour by the subjects, such as chasing and intimidating individuals, was considered distressing to them. The act of takingsomething belonging to another person, such as bread, biscuits, drinks, or agricultural products,is known as theft. The long-tailed macaques (*Macaca fascicularis*) broke into homes, mosques, and dorms as part of their breaking into human spaces. Damage to facilities, on the other hand,is the conduct of individuals who cause damage to property, including light posts, electrical wires, automobile wipers, clotheslines, and so forth.

The most frequent nuisance behaviours were theft (12%), damaging facilities (8%), messing up trash cans (24%), and annoying visitors (22%). Littering accounted for 34% of all nuisance behaviours (Zamri and Md-Zain, 2022). Macaques have been known to break into people's homes and take food and other belongings. They have also been known to throw trashfrom garbage cans outside, creating an unpleasant odour in the neighborhood (Hambali et al., 2012).

2.3 Population of Long-Tailed Macaques

According to IUCN (2022), due to several risks, there may have been a population reduction of at least 40% throughout the previous three generations, and it is suspected that this decline will rise and approach 50% over the following three generations. Populations are declining in numerous areas of the subspecies' range, even though it is thought to be adaptive and may be found in a variety of degraded habitats (Kyes et al., 2011; Lee, 2011; Hansen et al., 2019). For example, there are reports of significant local decreases and even completedisappearances in Cambodia and Lao People's Democratic Republic (PDR) (Lee, 2011). In 2008, a survey of suitable habitats and meat markets in Cambodia revealed the absence of long-tailed macaques (Lee, 2011). In 2009, a similar survey conducted in Java, Indonesia, found no long- tailed macaques in appropriate woodlands (Kyes et al., 2011). The total population of Lao PDR is now estimated to be between 300 and 500 people which is a 90% decrease from the average reported (San & Hamada, 2011).

In the past decade, populations in a regularly monitored region in Cambodia have seena concerning 50% decline, as reported by Nuttal et al. (2021). Suzuki et al. (2017) documented a decrease in the encounter rate of long-tailed macaques captured by video traps in a different Cambodian area from 2013 to 2014. Similar alarming trends are observable in the population dynamics of Bonnet Macaque (*Macaca radiata*) in southern India, where habitat degradation,adverse interactions, and increased group migration from wooded areas to human settlements have contributed to a significant drop in populations over time (Singh, 2019). Despite the species' synanthropic distribution, highlighted by Hansen et al. (2019, 2021), it appears that theactual

prevalence of these macaques is underestimated. Habitats that are both natural and widespread seem to harbor fewer individuals due to customarily overlooked or regionally specific extinctions, as observed in the case of Cambodia (Kyes et al., 2011; Lee, 2011; Hansen et al., 2019), and likely occurring in other countries as well.

2.4 The Human-Macaque Interaction

Every aspect of macaque behaviour and ecology has been influenced by human interaction. The presence of humans was the primary anthropogenic disturbance to long-tailedmacaques on the Malaysian campus of the University of Malaya (Koh & Rashid, 2020). The spread of human settlements into macaque habitats has exacerbated conflict between people and macaques. Macaques frequently demonstrate pestilential tendencies towards humans, including hostile behaviour, food thievery, bag snatching, garbage can scoff, building breaking,and property destruction (Md-Zain et al., 2010). One-third of respondents to a study by (Sha et al., 2009) on human-macaque interactions and society perceptions in Singapore cited annoyance issues from long-tailed macaques, including item theft and threats. Conflict betweenmacaques and humans in Singapore seems to be largely influenced by the attraction of human food sources (Sha et al., 2009). The abundance and widespread availability of food in places close to human settlements appears to attract the long-tailed macaque population that is beingseen at the entrance of Kuala Selangor Nature Park, Malaysia (Hambali et al., 2014). Unexpected effects of human-directed food provisioning could include raising macaque population densities and preventing macaques from independent foraging. Despite their habit of crop-

raiding and other nuisance behaviours, long-tailed macaques are known to form sympatric partnerships with people (Abdul-Latiff et al., 2019). Macaques could forage in large groups of 20 to 50 people to consume all kinds of crops in the mixed gardens (Permana et al., 2020). Moreover, zoonotic infections can spread between humans andmacaques due to contaminated food, drink, and contact. To date, few studies have methodically measured these zoonotic hazards (Stark et al., 2019). Furthermore, contaminated food, drink, and touch can result in the transmission of zoonotic illnesses between humans and macaques. Few researches have carefully quantified these zoonotic risks to date (Stark et al., 2019).

2.5 Case study

According to Badrul Munir Md. et al. (2001), previously conducted a study at the main campus of Universiti Kebangsaan Malaysia (UKM), located in Kajang, Selangor, Malaysia, examining the perspectives of UKM students and the nuisance issues arising from interactions with long-tailed macaques. Numerous studies have explored the behavior of long-tailed macaques, including investigations into their daily routines and conflicts with humans in residential educational institutions for students. Beyond theseefforts, extensive research has been dedicated to studying conflict issues in human settlement areas. In 2003, Tuan-Zubaidah conducted a study on the disruptive behavior of long-tailed macaques in the Bukit Lagi human community in Kangar, Malaysia. Suhailan (2004) study on macaque behaviour in local families in West Country, Bangi, while Sia (2005) conducted study on the everyday activities and disruptive behaviour of long-tailed macaques in Taman Tenaga,

Puchong, Selangor. These collective studies provide valuable insights that can assist Malaysian district councils and the Department of Wildlife and Natural Parks (DWNP) in effectively managing human-macaque conflicts while ensuring the preservation of the species.

CHAPTER 3

MATERIAL AND METHODS

3.1 Study Area

Sekolah Menengah Kebangsaan (SMK) Tinggi Port Dickson, Port Dickson, Negeri Sembilan has been selected to conductresearch of pest behaviour of long-tailed macaques (*Macaca fascicularis*). This school was located at 2.5218515° N, 101.8198339° E (Figure 3.1). The school is located near the beach. In the school area, there are several facilities provided to students and teachers. Among them are administrative offices, teachers' rooms, classrooms, football fields, and basketball courts.

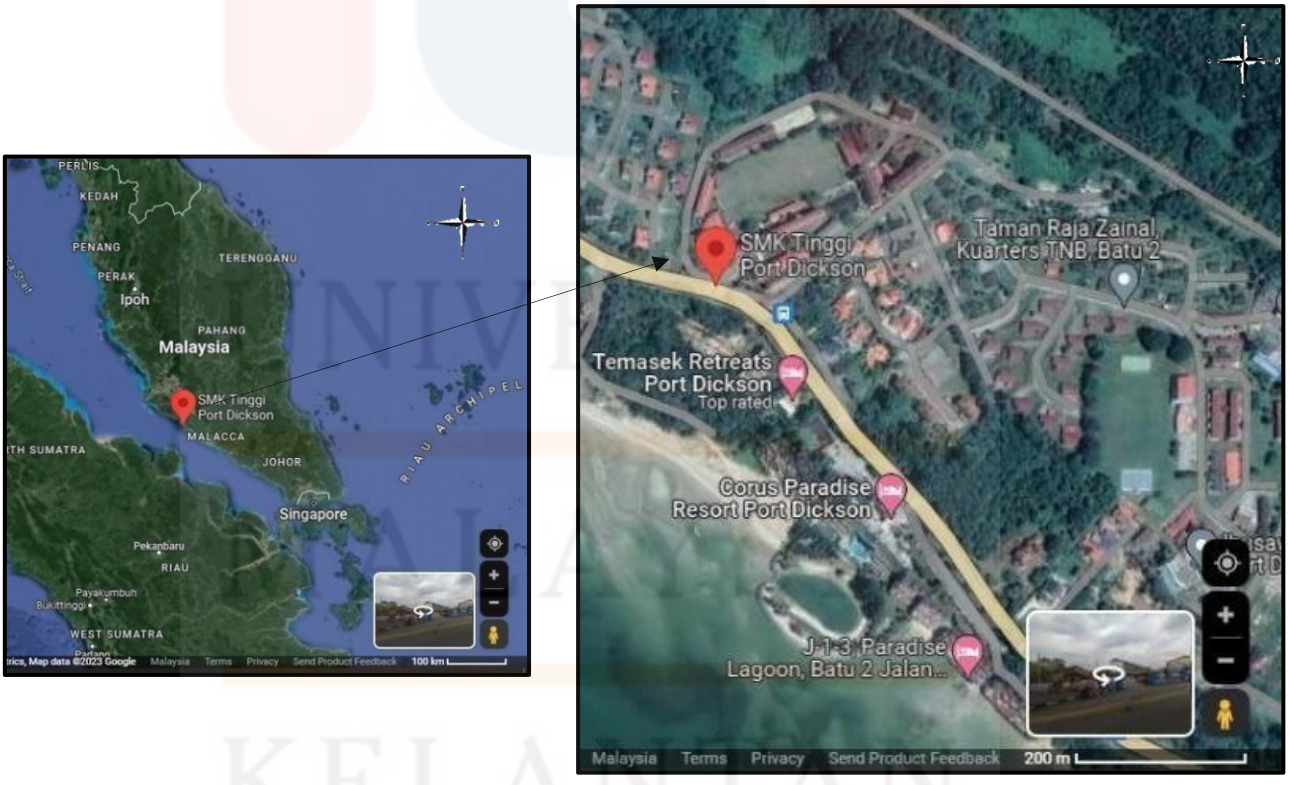

Figure 3.1 Map of SMK Tinggi Port Dickson, Port Dickson, Negeri Sembilan, Peninsular Malaysia (Source: Google Maps)

3.2 Materials

In this investigation, binoculars were used to confirm the identification of long-tailed macaques at the species level and to observe their pest behavior. The latitude and longitude coordinates of the point counts were then recorded using the Global Positioning System (GPS). Cameras are also used to capture images that will be used as evidence in research.

Table 3.1: List and pictures of materials (Source: Google Image)

Material	Picture
Binocular	
Global Positioning System(GPS)	
Camera	

3.2 Methods

3.2.1 Direct Observation

Generally, for 25 days, observations of monkey pest behavior were conducted between the hours of 0800 and 1200 and 1500 and 1900, six days a week. The focus of the investigation is SMK Tinggi Port Dickson. Groups of long-tailed macaques (*Macaca fascicularis*) have been recognized by their physical characteristics and by the way each member moves in unison with the group to confirm that they are all members of the same group. Quantitative information about macaque pest behavior at 10-minute intervals was obtained using an interval scan sampling approach. Six categories of macaque pest behavior were identified and observed including messing with trash cans, littering, disturbing people, stealing, trespassing on school grounds and damaging facilities (Table 3.2). All forms of aggressive activity, such as threatening, biting or scratching, and chasing individuals, disturb people. Taking food from students is referred to as stealing. They break into schools, classrooms, and prayer halls by breaking into buildings. The actions of those who cause harm to personal property are known as vandalism. Rainy or cloudy weather should not be used for this type of observation because the subject will usually disappear or become partially covered.

Table 3.2 Pest behaviours of *Macaca fascicularis* with descriptions (Zamri and Md-Zain, 2022).

No.	Pest Behaviour	Description
1.	Messing up garbage cans	Messing up garbage cans
2.	Littering	Litter garbage all over the place
3.	Disturbing people	All aggressive behaviour by the macaques such as threats, scratching or biting and chasing people
4.	Stealing	Grabbing food and people's belongings
5.	Breaking into school area	Broke into school, classroom, prayer hall
6.	Damaging facilities	Damaging facilities belongs to human

3.2.2 Questionnaire Survey

Questionnaire-based surveys focus on people's attitudes, beliefs, and level of knowledge on apes. There will be about 100 respondents in all who have been studied. There are about three sections to the questionnaire (Part A, B, and C), where Part A of the questionnaire asks about the personal information of the respondent. Respondents are questioned about their general knowledge of long-tailed macaques in Part B and their experiences, perceptions, and attitudes towards them in Part C. The purpose of this questionnaire study was to learn more about the problems surrounding the disruptions caused by long-tailed macaques (*Macaca fascicularis*) at SMK Tinggi Port Dickson. This study aims to identify the most effective way to deal with issues that arise in the educational environment, and the findings of the study can be referred to by relevant parties.

3.3 Data Analysis

The Chi-square (X^2) test was used for analysing potential differences in the distribution of certain pest behaviour categories among long-tailed macaques. This made it easier to identify the pest behaviour categories that were more prevalent than others. Data from questionnaires is also analysed using the Excel.

$$\chi^2 = \sum (O - E)^2/E$$

where

- O = observed value (actual value)
- E = expected value.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Direct Observation

Six pest behaviours by long-tailed macaques were monitored throughout the study and recorded based on the frequency of occurrence. The most monitored pest behaviour of long-tailed macaques was breaking into school area (37.17%), followed by messing up garbage cans (24.08%), damaging facilities (16.75%), littering (16.49%), stealing (3.14%) and the lowest was disturbing people (2.36%). Throughout the observation, macaques were observed to frequently trespass into classrooms and steal student belongings, particularly food, to disrupt the learning environment. In addition to biting automobile wipers, electrical cables, and antennas, macaques are known to cause damage to buildings when they jump and play on the roofs of schools, prayer halls, and corridors. Littering and messing up garbage cans were shown to occur regularly. Chi-square test result showed that all six pest behaviours of long-tailed macaques have significant difference (X^2=197.86; df=5; p<0.0001) (Table 4.1).

Table 4.1 Percentage and frequency of pest behaviours of long-tailed macaques and showed significant differences ($p<0.001$) by using the chi-square test (X^2).

Pest Behaviour	Percentage (%)	Observed	Expected	X^2
Messing up garbage cans	24.08	92	63.67	12.61
Littering	16.49	63	63.67	0.01
Stealing	3.14	12	63.67	41.93
Disturbing people	2.36	9	63.67	46.94
Breaking into school area	37.17	142	63.67	96.38
Damage facilities	16.75	64	63.67	0.00
Total	**100**	**382**	**382**	**197.86**

Breaking into school grounds (37.17%) is the highest percentage of pest behaviour recorded where long-tailed macaques often invade school areas, which are classrooms and prayer halls. Macaques often break into the school area in the morning and into the classroom during recess hour. Normally, macaques will break into the classroom more often to find food. Long-tailed macaques always invade the school areas because there is a forest area behind the school. This causes there to be a long-tailed macaque habitat in the area and the long-tailed macaque can find food easily. Other than that, long-tailed macaques (*Macaca fascicularis*) break into school areas primarily due to habitat fragmentation and increased overlap between human and macaque territories. Urbanization and deforestation reduce their natural habitats, forcing them to adapt to urban environments where they search for food (Entezami et al., 2024).

Next, the lowest percentage pest behaviour of long-tailed macaques is disturbing people (2.36%). Current observation, long-tailed macaques are seen disturbing students and others by making noise and being aggressive towards them parallels the fact that apes tend to be aggressive when people approach them. Long-tailed macaques usually like to disturb the students in their groups to scare the students. For example, a male macaque signals to his friends by making loud noises to scare the students.

Besides, the percentage of messing up garbage cans (24.08%) shows the highest compared to stealing (3.14%). Long-tailed macaques spend more time searching for food. They are aware that there is a high level of food waste in the trash. During the investigation, long-tailed macaques were frequently observed tampering with open garbage cans. This makes it easier for long-tailed macaques to locate their food. Long-tailed macaques typically enjoy tampering with garbage cans in the mornings and evenings. Long-tailed macaques steal students' property by breaking into classrooms. For example, the long-tailed macaques steal food containers and shoes.

In addition, damage facilities (16.75%) shows a higher percentage compared to littering (16.49%). Long-tailed macaques are known to cause property damage. Long-tailed macaques are frequently spotted causing damage to school property by jumping and playing on the roofs of classrooms, corridors, and mosques, causing significant damage to the roof. In addition, the monkeys caused damage to the teacher cars in the surrounding region. For example, biting car antennas and wipers, as well as defecating on vehicles. Long-tailed macaques' litter by grabbing leftover food from garbage cans and carrying it away to avoid competition with others. Then, after eating, long-tailed macaques hurl containers and plastics for food such as polystyrene,

plastics, bottles, and so on to the ground, spreading rubbish from the trash can everywhere.

4.2 Questionnaire Survey

A total of 100 questionnaires had been collected. The questionnaire is distributed randomly among SMK Tinggi Port Dickson students. Table 4.2 shows the frequency and percentage of information provided for different respondent types. Most responses (30%) are 13 years old, followed by those aged 14 years old (27%), 15 years old (13%), 16 years old (20%), and 17 years old (10%). There were 35 males (35%), and 65 females (65%) among the responses. Malays accounted for most responders (81%), followed by China (11%), and India (8%).

Table 4.2 Age, race and gender distribution of the respondents of the questionnaire survey.

Category		Frequency	Percentage (%)
Age	13	30	30
	14	27	27
	15	13	13
	16	20	20
	17	10	10
Gender	Male	35	35
	Female	65	65
Race	Malay	81	81
	Chinese	11	11
	Indian	8	8

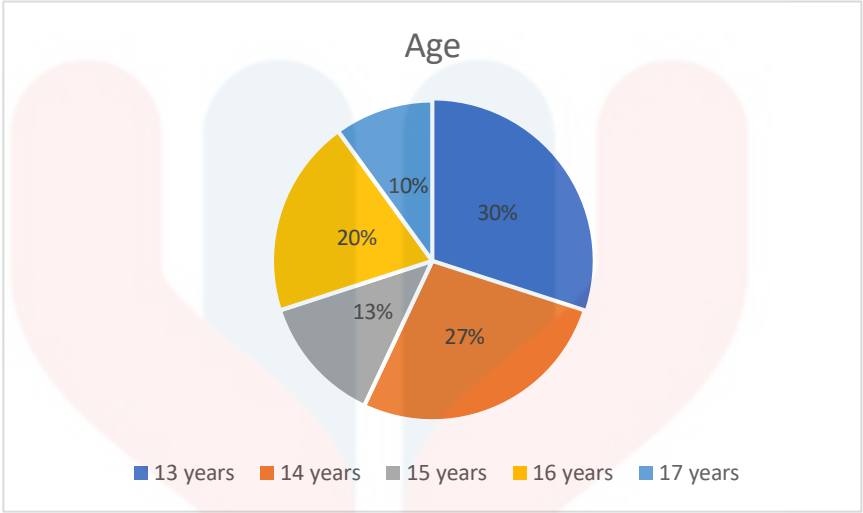

Figure 4.1 Age of respondents by the questionnaire survey.

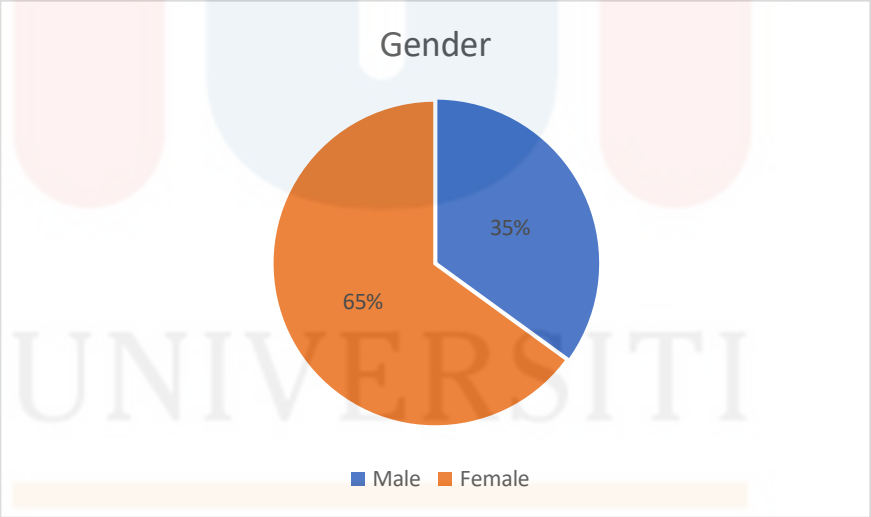

Figure 4.2 Gender of respondents by questionnaire survey.

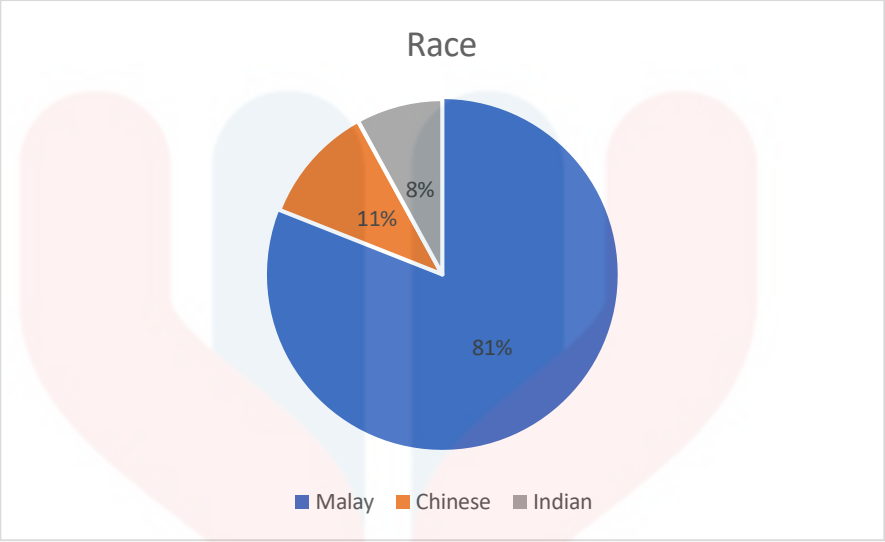

Figure 4.3 Race of respondent by questionnaire survey.

In terms of respondents' general knowledge of *Macaca fascicularis*, this questionnaire seeks to determine whether they can distinguish between *Macaca fascicularis* and *Trachypithecus obscurus*, the only two non-human primate species living at SMK Tinggi Port Dickson. In a general knowledge questionnaire about *Macaca fascicularis*, (88%) of respondents were able to distinguish it from *Trachypithecus obscurus*. Next, (82%) of respondents stated they knew anything about *Macaca fascicularis*, such as *Macaca fascicularis* forms huge groups and *Trachypithecus obscurus* produces vivid orange offspring. Most responders (92%) described *Macaca fascicularis* as a continual nuisance (pest) on their school grounds, and (93%) reported hearing about *Macaca fascicularis* nuisance.

Based to the questionnaire, most respondents reported that *M. fascicularis* visited the school area in the morning (0700 to 1100 hours) (46%), and in the evening (1400 to 1800 hours) (54%). Following to this study, *M. fascicularis* spends most of their time on school premises in the evening (1400 to 1800). This is since students and teachers are at home at that period. As a result, after recess, *M. fascicularis* travels on

to hunt for food and waste in garbage cans on the school area. Furthermore, there is a lot of waste and leftover food in the evening after time recess. This study is identical to those conducted by Hambali et al. (2012) and Md-Zain et al. (2010) on monkeys' daylight meal search. The presence of researchers has an indirect impact on the percentage of daily activity due to the lack of familiarity with humans. Macaques are diurnal, meaning they wander between areas to find food during the day.

The most common population size for *M. fascicularis* in the school area is 10-20 individuals (44%), followed by 1-10 individuals (28%), 20-30 individuals (16%), and uncountable (10%) (Table 4.3). Macaques have a strong tendency to migrate in groups for a variety of social and ecological reasons that help them survive and reproduce. Group living gives macaques more security from predators because they can take turns keeping watch and collectively mob or intimidate prospective dangers. Furthermore, being part of a group allows for more effective foraging since numerous people can share information about food sources, improving the likelihood of finding and utilising these resources (Lucas & Corlett, 1998).

Table 4.3 Estimated number of macaques in a troop by respondent.

No. of macaques	Percentage (%)
1-10	28
10-20	44
20-30	16
Uncountable	10

In terms of the age range of *M. fascicularis* entering the school area, respondents indicated that adults make up the highest percentage (40%) followed by sub-adults (36%), with juveniles making up the lowest percentage (24%) (Table 4.4). The questionnaire's question on the size of the *M. fascicularis* population and age class is intended to measure how large the group and age class has created disruption in the school area. Adult *M. fascicularis* are more prone than juveniles to access school areas and participate in pest behaviour because they have more expertise and confidence navigating human contexts, having learned through repeated interactions with people and their surroundings. They are also better at detecting and exploiting food supplies, which are frequently abundant in schoolyards due to inefficient food storage, trash, and human feeding. Furthermore, adult macaques have increased nutritional needs, particularly during mating seasons or when rearing offspring, which causes them to incur larger risks to obtain food. Their dominance in macaque social hierarchies also helps them to take precedence over youngsters when it comes to high-reward foraging places like schools.

Table 4.4 Age range of *M. fascicularis* entering the school area based the questionnaire survey.

Age class	Percentage (%)
Adult	40
Sub-adult	36
Juvenile	24

Most respondents claimed that they had never been bitten by *M. fascicularis* (100%), followed by respondents who were afraid of *M. fascicularis* (82%), had seen *M. fascicularis* bothering others (72%) and most also claimed that they had been

bothered and chased by *M. fascicularis* (69%) (Table 4.5). Most respondents said that female students are the most bothered by *M. fascicularis*. Macaques that have been at the human settlements for a long time and interact with humans are no longer afraid with humans especially girls. This is because female students are more likely to bring food items such as snacks or fruits that attract monkeys. This causes *M. fascicularis* to prefer to disturb female students. Furthermore, the *M.fascicularis* may perceive female students as less likely to respond forcefully than male students, reducing the danger associated with approaching them.

Table 4.5 Percentage of respondents who were afraid, harassed or bitten by *M. fascicularis.*

Category	Percentage (%)
Afraid	82
Have been harassed	69
Seen other people harassed	72
Had been bitten	0

The presence of *M. fascicularis* in the school has various detrimental consequences (Table 4.6). Most respondents (81%) agree that their presence pollutes the school surroundings. Furthermore, respondents agree that the presence of *M. fascicularis* has an impact on the safety and health of teachers and students (85%), and they believe that the disruption caused by *M. fascicularis* is rising over time (78%). A total of (62%) respondents stated that *M. fascicularis* always enters the classroom to steal. *M. fascicularis* stole most of the the students' food (56%), drinks (15%), and other items (29%). Shoes are another example of such an item.

Table 4.6 The respondents' views on the consequences of the presence of *M. fascicularis*

Consequence	Percentage (%)
Deface school area	81
Affect the safety and health of teachers and students	85
Disturbances increase over time	78
Entered the classroom	62
Steal	75
---Food	56
---Drink	15
---Other items	29

Furthermore, respondents reported that *M. fascicularis* commonly disturbs some places (Table 4.7). According to respondents, the bestari block / level is the region most commonly impacted by *M. fascicularis*, accounting for up to (31%). The bestari / form block consists of students in forms 1 and 2. *M. fascicularis* frequently disturbs the block due to its nearness to the forest behind the school. As a result, the block becomes *M. fascicularis'* primary food source. This allows *M. fascicularis* to enjoy stealing student's food during breaks. They also enjoy rummaging through the garbage cans on each block and throwing trash, such as food packaging, around. Moreover, the assembly area has the lowest *M. fascicularis* frequency (15%). Every morning, *M. fascicularis* emerges from the forest and enters the school's assembly area in search of food. Respondents said that *M. fascicularis* would bounce around on the prayer hall roof to frighten students.

Table 4.7 Percentage of areas most frequently disturbed by *M. fascicularis* stated by respondents.

Areas	Percentage (%)
Prayer hall	19
Basketball court	17
Bestari block / level	31
Field	18
Assembly area	15

Table 4.8 shows the percentage of behaviour of *M. fascicularis* when entering the school area stated by the respondents. The most frequent behavior performed by *M. fascicularis* when entering the school area is messing up garbage can (41%). Next, respondents said that *M. fascicularis* steal food (34%) and chase people (25%) when entering school grounds. Almost all of respondents stated that they have grown acclimated to the pest behaviour of *M. fascicularis*, however they still agree to reduce this issue.

Table 4.8 The percentage of behaviour of *M. fascicularis* when entering the school area stated by the respondents.

Pest behaviour	Percentage (%)
Messing up garbage can	41
Steal food	34
Chase people	25

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The presence of long-tailed macaques (*Macaca fascicularis*) at Sekolah Menengah Kebangsaan (SMK) Tinggi Port Dickson has created a significant challenge for school members. The study identified six main pest behaviors exhibited by macaques: trespassing on school grounds, messing with trash cans, damaging facilities, littering, stealing and disturbing people. Among them, the most frequent behavior is trespassing on the school grounds (37.17%) and messing up the trash can (24.08%).

The survey questionnaire revealed that the majority of respondents were aware and accustomed to the ape's disturbing behavior. The study emphasizes that the behavior of ape pests is closely related to their foraging activities, often driven by the availability of food waste produced by humans.

Understanding this behavior is important for developing effective pest management strategies and ensuring species conservation. To reduce conflict between humans and macaques, a collaborative approach involving school management, local wildlife authorities and the Department of Wildlife Protection and National Parks (DWNP) is necessary. Implementing measures such as safe waste disposal systems, educating school children about proper waste management, and humane relocation of macaques can significantly reduce the nuisance caused by these animals.

5.2 Recommendation

To prevent monkey interference in schools, authorities should collaborate with the animal Department and National Parks (DWNP), the only organisation responsible for animal management in Peninsular Malaysia. The concept aligns with PERHILITAN and is validated by additional reports (Tuan-Zubaidah, 2003; Sia, 2004). Several measures can be used to prevent *Macaca fascicularis*, sometimes known as long-tailed macaques, from teasing trash cans. First and foremost, a monkey-proof garbage can is required. These containers should have sturdy lids and locking devices that monkeys cannot open (Sha et al., 2009). To prevent macaques from getting leftover food, ensure that all bins are continuously closed and securely fastened. Second, putting trash cans in enclosed spaces or installing obstacles to prevent access can further lower the risk of macaque disturbance (Hansen et al., 2021). Regularly cleaning the area around the litter box to remove leftover food and spills will also keep these primates away. Furthermore, teaching students and staff on the need of proper waste disposal and the implications of feeding macaques can assist to reduce human attraction (Sha et al., 2009).

Next, to prevent food theft, an accurate no-eating policy must be implemented and followed by all students and teachers, as feeding the macaques encourages their presence and brazen behaviour (Sha et al., 2009). Installing monkey-proof food storage containers, such as locked lockers or cabinets, can restrict simple access to snacks and food. Furthermore, food should not be left unattended or freely available, particularly in outdoor places. Second, establishing specific feeding locations that are enclosed or have barriers can help dissuade monkeys

(Hansen et al., 2021). Education programmes should also be implemented to educate students about the dangers of associating with monkeys, as well as the significance of hygiene and vigilance (Sha et al., 2009). This united approach has the potential to drastically minimise food theft by monkeys in schools. Lastly, the school also needs to put up clear signs around the school reminding everyone not to feed the macaques and to keep the area clean.

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APPENDIX A

Long-tailed macaque's pest behavior messing up garbage can

Long-tailed macaque's pest behavior stealing

Long-tailed macaque's pest behavior damaging property

Long-tailed macaque's pest behavior damaging property

Long-tailed macaque's pest behavior breaking into school area

Questionnaires were distributed to students

APPENDIX B

Tinjauan soal selidik di kawasan sekolah.

Kajian soal selidik ini bertujuan untuk mengenal pasti masalah gangguan Monyet *(Macaaca fascicularis)* di SMK Tinggi Port Dickson, Negeri Sembilan. Kajian ini diharap dapat mencari penyelesaian terbaik bagi mengatasi masalah ini di kawasan sekolah dan boleh dijadikan rujukan kepada mana-mana pihak yang berkaitan.

BAHAGIAN A (maklumat responden)

1. Umur:

_____

2. Jantina: (a) Lelaki (b) Perempuan
3. Kaum: (b) Melayu (b) China (d) India (e) Lain-lain

BAHAGIAN B (bulatkan jawapan anda)

1. Bolehkah anda membezakan antara Monyet dan Lutong? [Ya / Tidak]
2. Adakah anda tahu apa-apa mengenai Monyet? [Ya / Tidak]
3. Adakah anda tahu apa-apa tentang Monyet dan Lutong? [Ya / Tidak]
4. Spesies manakah yang sentiasa mengganggu kawasan sekolah? [Monyet / Lutong]
5. Pernahkah anda mendengar sebarang berita tentang gangguan Monyet? [Ya / Tidak]

BAHAGIAN C (bulatkan jawapan anda)

6. Pada pukul berapa Monyet datang mengganggu kawasan sekolah?
   A. Pagi (7:00a.m. hingga 11:00a.m.)
   B. Petang (2:00p.m. hingga 6:00p.m.)

7. Berapa ekor monyet yang anda lihat mengganggu kawasan sekolah?
   A. 1-10
   B. 10-20
   C. 20-30
   D. Tidak boleh dikira

8. Yang mana julat umur Monyet yang paling biasa anda lihat?
   A. Dewasa (bersaiz besar, skrotum besar, payudara memanjang)
   B. Sub-dewasa (lebih langsing, skrotum lebih kecil daripada lebih dewasa, payudara lebih pendek daripada betina dewasa)
   C. Juvenile (sederhana-kecil, jantina sukar dibezakan, berdikari pada ibu semasa dalam perjalanan)

9. Adakah anda takut dengan Monyet?
   A. Ya
   B. Tidak

10. Adakah anda telah diganggu atau dikejar oleh Monyet?
   A. Ya
   B. Tidak

11. Pernahkah anda melihat orang lain digganggu oleh Monyet?
   A. Ya
   B. Tidak

12. Adakah anda telah digigit oleh Monyet?
   A. Ya
   B. Tidak

13. Adakah kewujudan Monyet mencemarkan kawasan sekolah?
   A. Ya
   B. Tidak

14. Adakah anda rasa kewujudan Monyet menjejaskan keselamatan dan kesihatan semua orang?
   A. Ya
   B. Tidak

15. Adakah anda merasakan gangguan monyet semakin meningkat dari semasa ke semasa?
   A. Ya
   B. Tidak

16. Adakah Monyet masuk ke bilik darjah?
   A. Ya
   B. Tidak

17. Adakah Monyet mencuri atau mengambil apa-apa dari bilik darjah anda?
   A. Ya
   B. Tidak

18. Apakah jenis benda yang Monyet curi atau ambil daripada anda?
   A. Makanan
   B. Minuman
   C. Lain-lain, sila nyatakan _____

19. Di kawasan manakah paling kerap diganggu oleh Monyet?

   _____

20. Apakah yang akan dilakukan oleh Monyet apabila memasuki kawasan sekolah?
   1.
   2.