

# A Behavioral Study on the Bornean Orangutan (*Pongo pygmaeus*) in a Semi-wild Environment at Bukit Merah Orang Utan Island, Perak

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**Abstract:** Although orangutan (*Pongo pygmaeus*) is one of Malaysian iconic species, however when compared to other great apes this species is not well studied. Several good articles regarding this species in captivity are relatively limited. Due to this reason, a behavioral study of this orangutan (*P. pygmaeus*) was conducted at Orang Utan Island, Bukit Merah, Perak. The main objectives of this study were to understand the ethology of orangutan in a semi-wild condition and the space utilization of the orangutans that would help in giving picture of the animal's arboreal and terrestrial nature. Preliminary observations were carried out for five days in January 2016 and intensive observations were carried out for a month in February 2016. The observation method used was focal sampling with continuous reading. The observations were done by focusing on one individual subject for every one hour from 09:00 a.m. to 13:00 p.m. and from 14:00 p.m. to 17:00 p.m. The behavioral profile of the orangutans in semi-wild environment showed that resting, feeding, and playing are the three major daily activities of the orangutans on the island. In accordance with the purpose of this study, the result of the behavioral activities of orangutan can be used for the management and well-being of the orangutan in the study site. Hopefully, with the provided information, this will help to increase our understanding of orangutans' behavior in a semi-wild environment.

**Keywords:** Orangutan, behavioral study, activity budget, semi-wild environment

## 1. Introduction

Ethology is the scientific study of animal behavior in natural environments from biological perspective [1]. Animal behavior has always been a subject of interest amongst many behavioral biologist and psychologist. Biologists who study behavior in the laboratory or in natural environments, should consider that what an animal does cannot be isolated from the way in which it lives. The study of animal behavior has begun since the era of Aristotle, however the experimental approach of behavioral study was actually started during the Darwinian era [2]. Before Darwin, the approach of behavioral study is mainly for the purpose of how to increase productivity of livestock. With the conception and introduction gain from Darwinian theories of evolution, behavioral biologist began to focus more on the theoretical issues [3].

The study of primate social behavior is a flourishing area of research that allow scientists to get a better grasp on human behavior and evolution as well. According to [4], the term social associated with behaviors such as friendship, association or assembly. This means that any acts or activities which involves mixing between one or more persons is

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considered as social activity. Social activities or socialization usually involves interaction within and between groups. These interactions are highly dependent on specific relationships and patterns of behavior in some species [5]. In another word, the social behavior of animals occurs directly and is influenced by the group to which they belong [6]. When we gain insight into animal behavior and their needs in terms of space utilization, diet and group organization, we are in a stronger position to have better understanding on what is necessary to preserve the wild habitats of primates.

In the early 1960s, it became known that the orangutans has been threatened with extinction and the interest in orangutan suddenly increased [7] [8]. Indonesia and Malaysia both was put in place of legislation to protect the orangutan but, ironically, not its habitat [9]. Despite legal protection, laws remain difficult to enforce. Over time, orangutans have lost their habitat greatly and has been under threat from human populations [10] and human activities such as agricultural activities, large-scale commercial logging and hunting [7] [11]. Since there is a transition of habitat from original to a semi-wild condition, therefore, this research will analyze their social behavior in referring to a process of familiarization of their environment co-existing with humans and man-made structures, which is different from the original habitat.

Orangutans in Malaysia is a fascinating being that has not only been contributed to development of ecotourism industry, but also becoming the choice of several foreign researchers to do their research, especially at the Sepilok Rehabilitation Centre in Sabah. There have been countless studies over the last two decades regarding orangutan's behavior. For instance, a behavioral study on Bornean orangutan (*Pongo pygmaeus*) in semi-wild state was carried out in Sarawak by [6]. However, the behavioral study conducted by [6] only focus on young, orphaned animals and the study was confined to that stage of lives when the animals were brought up in a semi-wild setting. Thus, purpose of this study will enable us to get better understanding on behavior pattern of orangutans from ecological perspectives in a semi-wild condition and space utilization, specifically their arboreal and terrestrial nature. Therefore, we hope that this study will lead to better understanding towards the management and well-being of the orangutans in the study site as well as in other related institutions.

## 2. Materials and Methods

### 2.1 Study Site

Bukit Merah Orang Utan Island (5.0088° N, 100.6757° E) located at Semanggol, Perak is approximately 285.6 km from Kuala Lumpur and 70.4 km from Georgetown, Penang. This island covers an area of about 15 acres of dipterocarp forestland that consists of indoor enclosure and outdoor enclosure and five acres of which has been set aside as a research center for these endangered species (Fig. 1). Orang Utan Island was chosen to be the native home of the orangutan because the climate and vegetation in the location are rather similar to the Borneo and Sumatra. The main goals of the Orang Utan Island are conservation, education, breeding, tourism, and research.

There were 17 orangutans in the island, of which at least 10 to 15 of them were born in the island. The orangutans were housed in the indoor enclosure every evening until the next morning before they were released into the outdoor enclosure which was also the exhibit where orangutans were observed (Appendix A). In the exhibit, visitors go through a 200-metre tunnel to look for the orangutans who roam freely within the exhibit. The tunnel gives visitors a safe way to observe the orangutans in their natural environment. The semi-wild condition encourages more natural behaviors of the orangutan that often lack in most zoos and recreational parks.

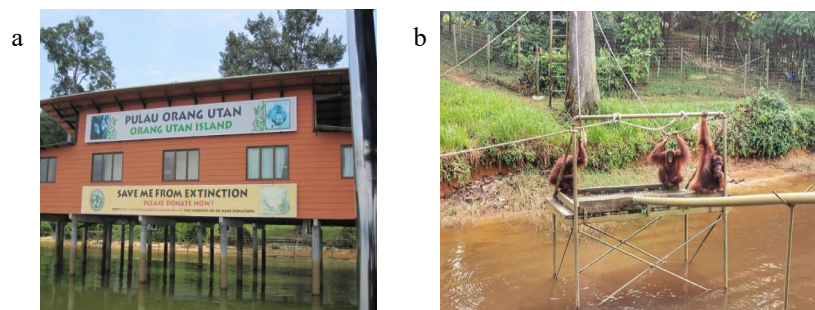


Fig. 1 - (a) Bukit Merah Orang Utan Island; (b) Orang Utan free-ranging area

### 2.2 Orangutans on the Orang Utan Island

All the orangutans on the island were originate from the Bornean subspecies. There was a total of 17 orangutans on the island that consists of six adults, three juveniles, six sub-adults and two babies. From a total of 17, half of them are females. According to the caretaker, the earliest orangutans were brought in from Borneo, making Orang Utan Island the first ex-situ conservation in Malaysia. There is an intensive on-going, breeding program for this unique great ape

subspecies that is endemic to the island of Borneo. For instance, one of the orangutans in the island named Marina was brought from Zoo Melaka for breeding program.

Among these 17 orangutans, four were selected to be the study subjects at the initial stage of the observation. However, later, when one of the adult females named Nicky was discovered sick, she was kept in the den and not released into the exhibit where she could be observed. As such, there were three study subjects at the later stages of the observation that consists of an adult male and two sub-adult that of male and female. Table 1 shows the information on sex, age, and class of each subject. The orangutans would be released from the indoor enclosure to the exhibit every morning at 0830h and kept in the enclosure again at about 1800h. The details of the subjects are as follows:

**Table 1 - Details of the subjects**

| <b>Name</b> | <b>Sex</b> | <b>Age</b> | <b>Class</b> |
|-------------|------------|------------|--------------|
| Adam        | Male       | 13         | Adult        |
| Tuah        | Male       | 09         | Sub-adult    |
| Karina      | Female     | 10         | Sub-adult    |

### 2.3 Sampling Methods

Two types of observation were carried out in observing orangutan's behavior which consists of Preliminary observation and Intensive observation. Preliminary observations were carried out for five days starting from 20th to 25th January 2015 while Intensive observation were conducted approximately for a month in between 26th January to 25th February 2016.

During preliminary observations, the Ad libitum sampling method was used. For Ad libitum sampling method, whatever was visible and seemed relevant at that time was simply noted [12]. Preliminary observations were preceded as informal observation sessions to understand and describe both the subjects and the behavior that were intended to measure. Preliminary observation is important because it requires familiarity with the subjects and their behavior in choosing the right measures and recording methods [12].

The focal sampling method with continuous reading was used during the intensive observation. One individual was observed for a specific amount of time and all instances of its behavior - usually for several different categories of behavior will be recorded. Generally, focal sampling is considered the most satisfactory approach to studying groups [12]. The observations were divided into two sessions: from 0900h until 1300h, and from 1400h until 1700h.

In this study, one-hour intervals was used as an observation period for each subject before moving on to the next subject. Observation was conducted for 55 minutes on each subject and the remaining five minutes used to rest so that the error can be reduced. All subjects have the same opportunities as each subject has 70 hours of observation during the 30-days of sampling period. Stopwatch was used to count time taken for each behavior categories of the subject and next noted in the schedule of behavior list (Appendix B).

Focal sampling can be particularly difficult under semi-wild conditions as the subject was usually partially obscured or moved completely out of sight, in this case recording must stop until it was visible again. To solve this problem, any such interruption was recorded as 'time out', and the final measure was calculated according to the time for which the subjects were visible.

The behavior categories were based on studies [13] and [14] that were modified accordingly to accommodate the behavior of the orangutans in semi-wild condition as shown in Table 2.

**Table 2 - List of the orangutan behavior categories**

| <b>Behavior categories</b> | <b>Descriptions</b>  |
|----------------------------|--|
| Resting                    | Includes all activities which took place while the subjects were relatively immobile in sitting or lying position.   |
| Locomotion                 | Includes all time the subjects traveled on the ground or from one tree to the next. Common locomotors pattern including brachiating, hanging, clinging, and walking quadrupedally. Any period immobile between moving bouts which exceeded one minute is counted as resting. |
| Feeding                    | Includes all the time the subjects spent looking for, reaching for, extracting, handling, chewing and swallowing food, as well as short movements within a feeding area. Drinking is also included in this category.   |

|                 |   |
|-----------------|---|
| Grooming        | Includes all the time the subjects groom or scratch their arms, legs, chests, throat sacs and cheek pads. They may use lips, fingers, back of their hands or feet for this purpose. This includes self-grooming as well as social grooming. |
| Playing         | Includes solitary as well as social play. The behavioral components identified include following, hand contact, mouth fighting, dragging, and pushing. Self-decoration is also included.  |
| Manipulating    | Includes tool-using, nest-building and all the time the subjects manipulate objects or electric fence.  |
| Nesting         | Nest building behavior by collecting materials from surrounding environment and manipulate it to build a nest during resting.   |
| Sexual behavior | Includes approaching, presenting, and genital inspection and attempted or completed copulations.  |
| Observation     | Observing the surrounding environment, eyeing the bushes, visually looking for non-food objects and resting area as well as visitors at the outside of the exhibit.   |
| Others          | Includes other behaviors which are not included in the above categories, such as urinate, defecate, does tricks, or be showered.  |

## 2.4 Data Analysis

Non-parametric tests are more useful in analysis of non-normally distributed data. The tests that were chosen to analyze the quantitative data were Mann-Whitney and Kruskal-Wallis tests. Generally, the non-parametric tests are slightly less powerful than the equivalent parametric tests. However, since they are free from the assumptions of parametric tests, they are more robust; that is, less dependent on various assumptions about normality and so on for their validity. On the other hand, it is more useful for research with small sample size ( $n < 10$ ) [12]

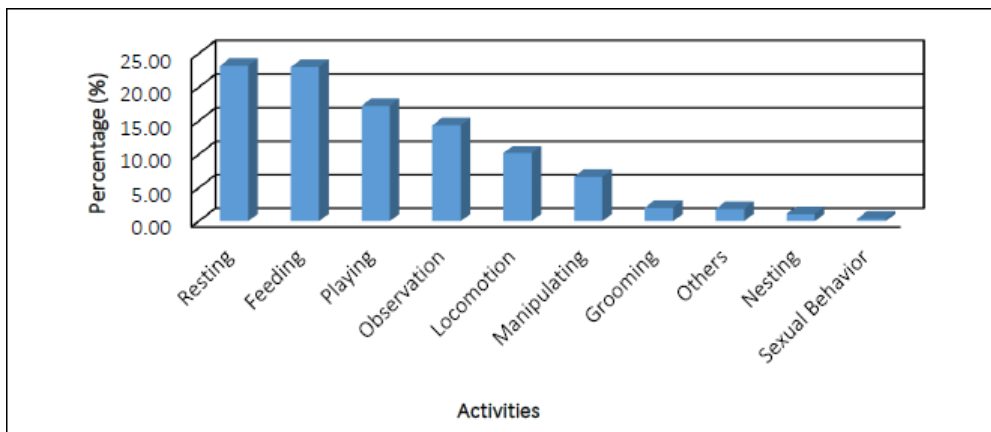
Mann-Whitney and Kruskal-Wallis test was tested via SPSS software version 22 to analyze the findings. Mann-Whitney test was used to identify the relationship between the two sessions (morning and evening) and Kruskal-Wallis test was used to detect whether there is a significant difference between each category and the behavior of the subjects in each category of behavior.

## 3. Results and Discussion

Through 30 days of sampling, total hours successfully observed for orangutans by focal sampling were 175 hours. Nearly 17 hours of observation unsuccessfully recorded due to the condition of the weather and subjects were partially obscured or move completely out of sight.

### 3.1 Time Allocation of orangutan's daily activities in a semi-wild environment and comparison with the wild Bornean orangutans

The orangutans spend most of their daytime doing several types of behavior such as feeding, resting, grooming, playing, locomotion, manipulating, nesting, sexual behavior, observation, and others. As shown in Fig. 2, the orangutans spent most of their time resting (23.20%), followed by feeding (23.00%) and playing (17.25%). These three activities made up a total of 63.45% of the observation time and it is the major daily activities of the orangutans studied on the island. On the other hand, orangutans did spend their daily routines in activities such as observation (14.36%), locomotion (10.19%) and manipulating (6.64%). Only 5.34% of the observation time was made up from activities consists of grooming (2.02%), nesting (1.11%), sexual behavior (0.38%) and others (1.83%). Behaviors which are not included in the above categories, such as urinate, defecate, does tricks or spitting was categorized as others.

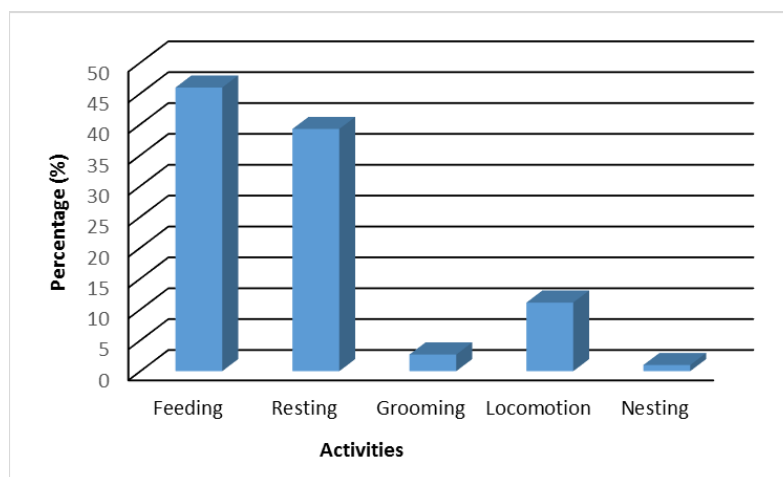


**Fig. 2 - Percentage of time allocation for orangutan’s daily activities in semi-wild environment**

Resting and feeding behaviors shows a slight similarity in terms of the percentage of time allocation for both activities. This is because, orangutans on the island preferred to rest and lazy to move around when they are full specifically after their feeding time. Kruskal-Wallis tests conducted have shown that there is a significant difference ( $p < 0.05$ ) among all categories of behavior for all the three subjects (Appendix C). Statistically, it shows that each subject shown different proportion of time spent for each category of behavior which will be discussed further in the next sub-topic.

From the study done by [15] at Borneo Orangutan Reserve in Kutai, Kalimantan, he found that, orangutans in the wild, most of the time spent feeding activity (45.95%), followed by resting (39.24 %), locomotion (11.11%), manipulation (2.70%) and only 1.00% for nest building behavior (Fig. 3). Compared to the orangutans in Kutai, Kalimantan, the orangutans on the island do not spend much time in feeding but spent more time in resting. This is probably because, in captivity, sufficient food was provided and ready to be given for the orangutans on the island. Thus, they did not have to look for food on their own and would probably spend the ‘additional’ time on resting [16]. This situation is different for the wild orangutans. In the wild, they need time to find their own food (foraging) and once they found the place, they will take longer time to consume all the food sources [10].

Study from [15] also found that the adult male fed the most and spent the least time moving. However, his finding seems to resemble the results of this study where the adult male, Adam spent the highest feeding time of 25.30% and the lowest locomotion time spent which is 5.24%. According to [15], he stated that males spent more time foraging than females. However, his finding was not in agreement with this study as the sub-adult female, Karina was found to have the highest percentage of time allocated for feeding (23.78%) as compared to Tuah (19.94%) under category of the same age group.



**Fig. 3 - Percentage of time allocation for Borneo Orangutan Wildlife Reserve in Kutai, Kalimantan**

In addition to feeding behavior, wild orangutans also use a lot of time in resting. This behavior was also shown by orangutans in the island who spent the most time in this activity by 23.20%. Wild orangutan spent longer time on resting as they must move a lot to find food in order to gain energy [9]. It is believed that wild orangutans move in a

much wider range compared to captive orangutans as captive orangutans do not have to find food and established their home range. Wild orangutans live in the forest area which allowed them to move to the desired extent. But orangutans in semi-wild as in Bukit Merah Orang Utan Island, can only move in an area of confinement or limited outdoor exhibition area.

Results of this study seem to agree with [15] findings as grooming contributed less amount of time spent by orangutans in their daily activities. According to [17], orangutans seem to have a low rate of grooming as compared to other apes and monkeys. [8] suggested that self-grooming usually occurred at the night, where the animals could not be observed. Similarly, grooming in captivity may happened in an early morning or late evening activity [17]. This may explain the finding of this study as the orangutans would only be released into the exhibit after 0830 and would be back into the dens after 1800 hours. Thus, it is a very rare occurrence and there is possibility that the grooming was performed out of the observation period (in their closed enclosure). However, during the observation periods, allogrooming were seen to be performed mostly by Adam (adult) through scratching, licking and face touching. Unlike Tuah and Karina, they spend most of their time playing, which includes solitary as well as social play. While for nest building behavior, orangutans in a semi-wild environment quite low spending time for nesting. It is probably due to the reason of lack of skills for nest building since most of the orangutans here has been separated from their biological mother since young. According to [18], skill is needed for nest building and it can be learnt from their parent or mother.

### 3.2 Comparison of Time Allocated for Daily Activities between Morning Session and Evening Session.

To compare orangutans’ daily activities between two sessions, the observation data were divided into two which consist of data from morning session (0900 hours until 1300 hours) and data from evening session (1400 hours until 1700 hours). Mann-Whitney U Test was used to test the relationship between the two sessions. The result shows that no significant difference among all the activities between morning and evening sessions (Table 3).

Table 3 shows the p-value is larger than 0.05, thus, we cannot conclude a significant difference exists between morning and evening session. It is probably because the orangutans were active both in the morning when they have just been released into the exhibit, as well as in the evening when the condition of the weather was not too hot. This could be noted in the daily activity patterns that showed most activities were conducted in the morning and in the evening, besides, the animals were fed throughout the day.

**Table 3 - Significant difference for allocation of time in daily activities between morning and evening session using Mann-Whitney U Test**

| Activities      | p-value |        |        |
|-----------------|---------|--------|--------|
|                 | Adam    | Tuah   | Karina |
| Feeding         | 0.2112  | 0.3162 | 0.3037 |
| Resting         | 0.6491  | 0.3769 | 0.4003 |
| Locomotion      | 1.0052  | 0.1494 | 0.5449 |
| Grooming        | 1.1200  | 0.4268 | 0.6230 |
| Playing         | 0.4570  | 0.2220 | 0.7624 |
| Manipulating    | 0.4240  | 0.8285 | 0.1834 |
| Nesting         | 0.5312  | 0.6221 | 0.4931 |
| Sexual Behavior | 0.4240  | 1.0242 | 0.3236 |
| Observations    | 0.8312  | 0.6621 | 0.7242 |
| Others          | 0.4240  | 1.0242 | 0.3236 |

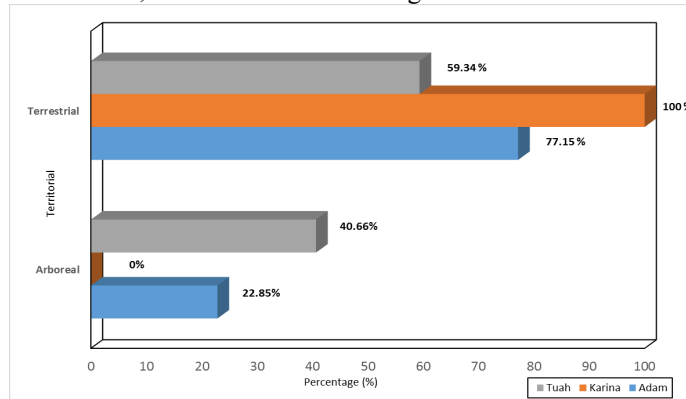
\*Shows significant difference (p < 0.05)

Generally, orangutans in the island were observed active in the early morning and late afternoon. This was mostly due to the weather condition as animals usually became inactive and completely obscured in the early afternoon when the weather was hot. This is supported by the study done by [8], at which he suggested that weather played an important role in affecting daily activity patterns.

### 3.3 Comparison of Arboreal and Terrestrial State

Fig. 4 shows that, study subjects in semi-wild environment spent most of their time on the ground. The only exception was Tuah who spent 40.66% of the observation time by climbing on trees and brachiating fixtures. This followed by Adam who spent 22.85% resting at his nesting site and Karina showed 0% in arboreal behavior. Tuah showed the highest arboreal behavior because he lives in the exhibit with the other two sub-adults, Fatt Fatt and Hiroshi. They seem to spend most of their time playing on the trees and hanging on the rope. However, Karina, sub-adult female showed the opposite behavior as Tuah. She spent most of her time solitary at her nesting site which is on the ground and showed a semi-social behavior with the other sub-adult female, named, April. Therefore, observation

period for Karina 100% happened on the ground. Adam, on the other hand, showed less arboreal activity as compared to Tuah probably because he lives in the exhibit alone, therefore, his arboreal activity just only when he went to rest at his nest. Most of the time, which is 59.34%, he was observed on the ground.



**Fig. 4 - Proportion of terrestrial and arboreal activity**

The observation result made is truly supported by statistical result run by Kruskal-Wallis test. Table 4 shows there is a significant different ( $p=0.00$ ) existed between arboreal and terrestrial state for each study subjects. It is because, not all subjects spent their majority time on the trees or on the ground. For instance, Adam’s arboreal activity is lower than Tuah, followed by Karina who showed zero arboreal activity. This is probably because, both Adam and Karina, regardless of the differences on their age-status, both are big in size as compared to Tuah.

**Table 4 - Comparison of arboreal and terrestrial state for each subject by using Kruskal-Wallis test**

| Behavior    | Kruskal-Wallis Test (p value) |
|-------------|-------------------------------|
| Arboreal    | .000                          |
| Terrestrial | .000                          |

\* There is a significant different ( $p<0.05$ )

Result from this study seemed to be supported by [19] findings at which orangutans’ body size is one of the barriers for them to performed terrestrial activities therefore, it is easier and safer for them to travel on the ground. This was also in agreement with [8] views where relationship could be made between ground walking and weight. According to [20], orangutans of about 100 kg, locomotion in trees was affected by weight. Despite many studies repeated the statement that orangutans are an arboreal species and the only one of the great apes to live almost exclusively in trees, [9]reported that from observations of 50 orangutans, some individuals spent as much as 50% of their time on the ground. A recent study on Bornean orangutans in zoo also showed that one of the captive orangutans spent more than 80% of its time on ground [9].

#### 4. Conclusions

In summary, orangutans in semi-wild environment spent most of their time resting (23.20%), followed by feeding (23.00%) and playing (17.25%). These three activities seem to be their major daily activities that made up a total of 63.45% of the observation time on the island. Qualitatively, orangutans in semi-wild environment showed too much resting behavior and less locomotion and foraging activity as compared with wild orangutans. In addition, orangutans in the exhibit were found to have abnormal growth behavior such as begging for food from visitors or stereotyped behaviors such as rocking and spitting. Orangutans’ behaviors seemed to be influenced by human’s activities. In terms of orangutans’ arboreal and terrestrial activities, orangutans in semi-wild conditions still spent some of their time on trees like their wild counterparts. However, their terrestrial behavior in the open exhibit is more prominent. On a side note, the mission of Orang Utan Island in terms of to promote the conservation of the orangutan through ex-situ efforts seem to be achieved as they have successfully bred here. However, further studies still need to be carried out in the future specifically on enrichment program. Environmental enrichment should be provided to orangutans in captivity as to ensure this animal will remain both physically fit and mentally healthy.

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### Appendix A: Plan of the exhibit at Bukit Merah Orang Utan Island, Semanggol, Perak



### Appendix B: Behavior List of Bornean Orangutan (*Pongo pygmaeus*) in Semi-Wild Condition

Place :  
 Weather :  
 Sex : Male / Female

Date :  
 Start :  
 End :

| 1 <sup>st</sup> Session | Resting | Feeding | Playing | Observation | Locomotion | Manipulating | Grooming | Nesting | Sexual Behavior | Others |
|-------------------------|---------|---------|---------|-------------|------------|--------------|----------|---------|-----------------|--------|
| 0900-1000               |         |         |         |             |            |              |          |         |                 |        |
| 1000-1100               |         |         |         |             |            |              |          |         |                 |        |
| 1100-1200               |         |         |         |             |            |              |          |         |                 |        |
| 1200-1300               |         |         |         |             |            |              |          |         |                 |        |
| 2 <sup>nd</sup> Session | Resting | Feeding | Playing | Observation | Locomotion | Manipulating | Grooming | Nesting | Sexual Behavior | Others |
| 1400-1500               |         |         |         |             |            |              |          |         |                 |        |
| 1500-1600               |         |         |         |             |            |              |          |         |                 |        |
| 1600-1700               |         |         |         |             |            |              |          |         |                 |        |

### Appendix C: Significant difference for activities of each Study Subjects Using Kruskal-Wallis test.

| Activities      | Kruskal-Wallis Test (p-value) |
|-----------------|-------------------------------|
| Feeding         | 0.322                         |
| Resting         | 0.000                         |
| Locomotion      | 0.000                         |
| Grooming        | 0.002                         |
| Playing         | 0.000                         |
| Manipulating    | 0.000                         |
| Nesting         | 0.003                         |
| Sexual Behavior | 0.109                         |
| Observation     | 0.061                         |
| Others          | 0.671                         |

Note: H = 499.72      P = 0.000      \* There is a significant different (p<0.05)



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