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Survey of *Long-tailed macaque*'s Behaviour in Mount Rinjani National Park, Lombok Timur

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Abstract. The research was conducted in Mount Rinjani National Park, Lombok Timur, to observe the daily activities of Long-tailed macaque in utilizing their habitat and vocalization analysis as a hallmark of species. The Long-tailed macaque' activities were analyzed using the scan sampling method. Ten (10) individuals of *Long-tailed macaque* were observed. The results showed that the observed activities of Long-tailed macaque were feeding, sleeping, inactive, grooming, mating, moving, excretion, playing, making sound, and agonistic (fighting). The average percentage of Long-tailed macaque observed was feeding (10.1%), sleeping (9%), inactive (9.4%), grooming (14.9%), mating (8.5%), moving (11.1%), excretion (7.9%), playing (9.7%), making sound (9.5%), and agonistic (9.9%). The daily activities can be as a reference in detecting the 'species' of the *Long-tailed macaque*. To support the population of this species, especially for long-term survival, the manager of the Rinjani Nasional Park should preserve the forest with conservation of natural forests and wildlife or biodiversity conservation and ecotourism, also prevent littering and illegal activities.

1. Introduction

One type of primate that is easily found in Indonesia is *Long-tailed macaque* which is a species of *M.fascicularis* and family of *Cercopithecidae primate* [1, 2]. Internationally, the conservation status of *Long-tailed macaque* is listed in the category of least concern by the International Union for Conservation of Nature (IUCN) Red List [3]. This is based on a wide distribution area, a large number of individuals in a population, high tolerance for all types of habitats, and distribution in some protected forest areas. Furthermore, it is estimated that the population has not decreased to the minimum number of individuals required to raise its conservation status to the threatened category.

Long-tailed macaque is one type of monkey that has a long tail approximately the same with a body length ranging from 38.5- 64.8 cm. Tail length in males and females is between 40.0-65.5 cm. Body color varies, ranging from gray to brownish with a white ventral part. *Long-tailed macaque* lives in groups with a social structure consisting of many males and females [4]. [2] reported that *Long-tailed macaque* has a wide distribution covering the mainland and islands of South East Asia at a position of 21° North latitude to 10° South latitude and from 92° to 126° East longitude.



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Habitat is an environment that has certain conditions so that a species or community can live [5]. Long-tailed macaque usually live in primary and secondary forests, from lowlands to highlands. Long tail macaque have behavior in response to something in their habitat. The daily behaviors of long-tailed macaque including moving (moving places), grooming, playing, inactive, eating, agonistic (fighting), sleeping, mating, and making sounds [6].

Long-tailed macaques are over a wide geographical area, and they can adapt to their environment. This monkey has the natural ability to utilize resources and face various environmental conditions [7]. This monkey species can be found living in mangrove forests on the seafront to mountainous forest areas [7, 8]. Populations scattered in various areas with different environmental conditions show different behavior of Long-tailed macaques. *Long-tailed macaque* is a type of primate that can stand and sit, walk upright, and use its hands for various purposes. They use their fingers to grasp, hang, take things, put food in their mouths, rub, scratch, and throw things [9, 10].

The study of monkey populations at Lombok Island has been carried out by [7] around Mount Rinjani and in several inland areas on protein variation. Those studies were conducted in a limited area. [9] reported the presence of the *Long-tailed macaque* species from the islands of Lombok and Sumbawa based on specimens examined in several museums. Currently, there has been no comprehensive study of the long-tailed monkey population in particular on Lombok Island. The comprehensive study is an ecological study that includes the distribution pattern of long-tailed monkeys as part of mapping the long-tailed monkey population in the world [2].

This study aims to support the species of *Long-tailed macaque* in Rinjani National Park, Lombok Timur by detected the population.

2. Methods

This study was conducted on Tuesday, November 2-30, 2019, this study was qualitative research, which is the type of research used in study of Long-tailed macaque's behavior in in Mount Rinjani National Park, Lombok Timur. The object of this study was the population of Long-tailed macaque in Rinjani National Park. The instruments used in this study as shown in Table 1.

Table 1. The instruments used in study of Long-tailed macaque's behavior

No.	Instrument	Used
1.	Watch	Determine the direction and coordinates of the sampling point
2.	Camera digital (Galaxy S10 with the 16 MP f/2.2 ultra-wide lens telephoto and lens 12 MP aperture variable with the resolution 1440p)	Documentation
3.	Stationery	Record the data
4.	Binocular	Observations
5.	References	Data Analyses
6.	Tally sheet	Determine the location

The material used in this study was population of Long-tailed macaque in Rinjani National Park, Lombok Timur. The observations were made at 3 points, namely the west, east and north. To determine the location of Long-tailed macaque based on the population.

The method employed in observing the behavior of Long-tailed macaque in this study was the focal sampling method [11, 12]. The focal sampling method is a method of recording the behavior of Long-tailed macaque when they make sounds, by observing one individual who is the focus of observation in a certain time interval [13-15]. The observations were made by collecting detailed data describing behaviors that might be overlooked by methods that do not require the observer to follow the individual in all stasis [16]. This method is more useful for detecting behavioral differences between individuals in social groups or for describing patterns of social interaction that occur.

The observations were made at 10 points determined by purposive sampling to survey the behaviour and 10 individual *Long-tailed macaque* has been observed, and the method used to record the total of three (3) hours' time from 10 am to 12 pm with 5-minute intervals times. The data of 10 individual *Long-tailed macaque's* behaviour were recorded.

The observations on each individual were conducted by observing and recording the Long-tailed macaque daily activities, namely feeding, sleeping, inactive, grooming, mating, moving, excretion, playing, making sound, and agonistic (fighting). The observed of eating behaviors include choosing, taking and putting the food into the mouth. Feeding activities consist of taking food, putting food in the mouth, storing it in the cheek pouch, and chewing and swallowing the food [17].

Inactive behavior is the resting behavior. Inactive activity is an activity when Long-tailed macaque is silent or not doing any activity. This activity includes the approach of the male to the female, such as grooming before copulation. Furthermore, genital checks are also carried out to enable the male to know when the female is in heat. Grooming is their cleaning behavior from lice that are carried out either on themselves (auto grooming) or with other individual assistance (allogrooming). Grooming is done using his fingers or with his lips [18].

Mating behavior is the behavior that is rarely carried out by Long-tailed macaque. Moving is the most frequent behavior at all observation points. Playing, mmm Playing is an activity that is usually carried out by young primates with other individuals or with certain objects. Voice behavior occurs when long-tailed monkeys move to find the food, and when agonistic or fighting. The aimed of making voice is to instruct their group for gathering, and to scaring the enemy, also to showing that they are superior.

Agonistic activity (fighting) including lunging, hitting, grimacing, threatening with mouth opening, chasing, crouching, and screeching [17]. Agonistics are divided into agonists into individual partners and other individuals who are not partners. The form of agonistic that is often done is in the form of threatening and lunging for food.

3. Result and Discussion

The results of observing the behavior of *Long-tailed macaque* in Mount Rinjani National Park, Lombok Timur shown in Table 2. The observations were made in a total of three (3) hours' time from 10 am to 12 pm to observe the activities of *Long-tailed macaque* per day, such as feeding, sleeping, inactive, mating, moving, playing, making sound, and agonistic.

Table 2. The results of observation of *Long-tailed macaque's* behavior in Mount Rinjani National Park, Lombok Timur

Individual	Total Activities in three (3) hours (duration time)									
	Feeding	Sleeping	Inactive	Grooming	Mating	Moving	Playing	Excretion	Making Sound	Agonistic
1	24	5	19	28	18	20	5	19	24	18
2	3	7	8	5	3	5	6	2	8	3
3	13	13	13	13	13	13	13	13	13	13
4	9	19	12	15	9	24	20	24	20	18
5	3	4	3	3	4	5	2	2	2	2
6	35	30	30	27	30	33	21	30	33	31
7	3	7	8	5	3	5	6	2	9	3
8	1	3	2	1	1	2	2	1	7	2
9	1	1	1	1	1	1	1	1	1	1
10	1	0	1	1	1	1	1	1	2	1
Average	9.3	8.9	9.7	9.9	8.3	10.9	7.7	9.5	11.9	9.2

Based on table 2 and figure 1, the average activities of Long-tailed macaque for three (3) hours times are not significant different between one activity to another activity. The average of feeding activity is 10 times in three (3) hours, it is not different with sleeping activity, mating activity, excretion activity, making sound and inactive, but for the grooming activity, they need more times. The results of this study are in accordance with [5], with the results are 13 times for inactive, 9 times for moving, and 16 times for grooming. For more details, this result was calculated in the percentage of the daily activities of Long-tailed macaque as shown in table 3.

Table 3. Percentage of daily activities of *Long-tailed macaque* in three hours times

Activity	Average of daily activity (duration time)	Percentage (%)
Feeding	9	9.4
Sleeping	9	9.4
Inactive	10	10.4
Grooming	10	10.4
Mating	8	8.3
Moving	11	11.5
Excretion	10	10.4
Playing	8	8.3
Making sound	12	12.5
Agonistic	9	9.4

According to the table 3 and figure 2, the most frequent activity is grooming. Grooming (Self-care) is one of the typical Long-tailed macaque activities with a percentage of 14.9% of the total activities. This record is in accordance with [16, 19], where the grooming activity is 11,55% of the total activities. The grooming activities are mostly carried out by the female Long-tailed macaque. [20] stated the grooming patterns have been of particular focus in measuring and understanding female relationships and are a useful indicator of female social bonding. Moreover, the second most frequent activity is moving 11.1%. [17, 21] explains that moving behavior includes climbing, jumping, walking, and moving places. Based on the observations in this study, Long-tailed macaques often move around for search of food and for another activities, such as playing and mating.

According to [22], the high percentage of the moving activity from one tree to another in search of food, looking for other individuals to gather with members of the group, and carrying out activities such as playing and resting activities. The others activity that is often done is feeding, playing and agonistic as much as 10% of the total activities. Eating is a routine activity for Long-tailed macaque to survive.

Sleeping or resting activity was recorded with a percentage of 9 % of the total activities. Resting is a period of inactivity of wild animals in any form [23, 24] Rest is done to recover the energy used in carrying out further activity. This can be influenced by the time by the time of observation. If the observation was carried out in the afternoon, it would be more frequent to rest due to fatigue from all-day activities. The form of resting behavior that is often carried out by *Long-tailed macaque* is sitting and standing on the tree.

Rest is an important activity because *Long-tailed macaque* requires special time to rest for maximum efficiency and in digesting food [25], because *Long-tailed macaque* consumes high-calorie foods [4, 8]. Another factor is thermoregulation for when the weather is hot, *Long-tailed macaque* tends to rest by taking shelter under a tree to avoid the hot sun [9]. According to [26, 27], the *Long-tailed macaque* is a diurnal primate that tends to move more to find food.

The mating activity observed was 8.5% of the total activity. This result is higher than [5], when the result it was 3.5% for the mating activity. Mating activity can affect the number of individuals in the group. The hierarchy in *Long-tailed macaque* also affects mating intensity, such as the dominant male species (*alpha male*) being able to mate more often than other male monkeys. Moreover, other males might fight each other to mate with the desired female.

Agonistic behavior was encountered during the observation. It was 9.9 % of agonistic behavior was found such as fighting behavior on the ground by staring, making sounds, showing sharp fangs, and sometimes using sharp nails to claw their opponents, namely individual monkeys from other groups and mating [26]. This behavior was carried out in daily activities when the male *Long-tailed macaque* sits, dwells in several places found such as on the ground, in other places, which is done by approaching the female and then being invited to have sex by the male. In this study, it was found that sometimes the female was who approached the male first to be invited to have sex.

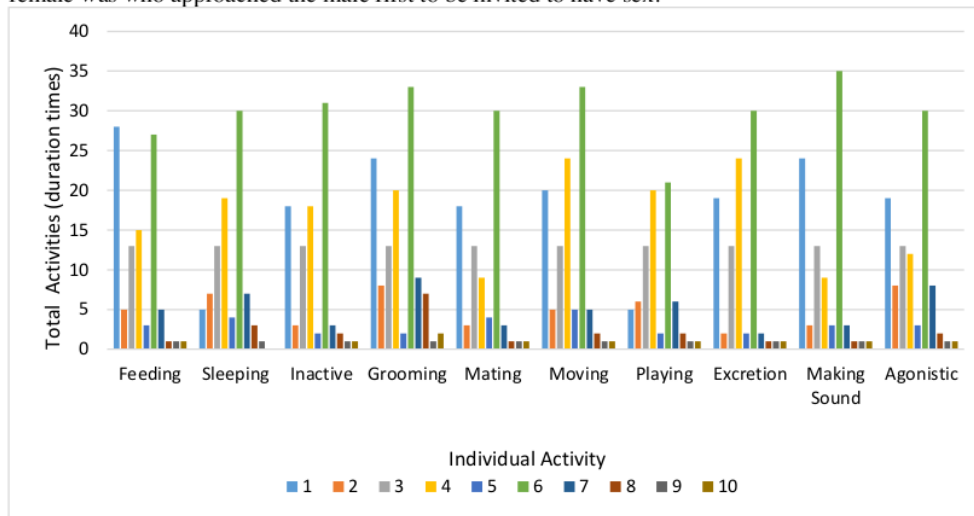


Figure 1. The behaviors of 10 individuals *Long-tailed macaque*

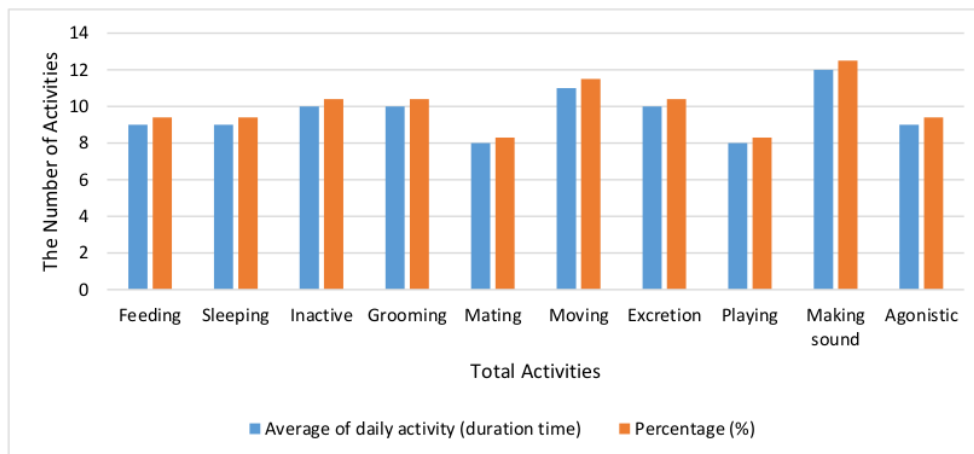


Figure 2. The average percentage of Long-tailed macaques' activity

4. Conclusion

The results showed that the observed activities of *Long-tailed macaque* were feeding, sleeping, inactive, grooming, mating, moving, excretion, playing, making sound, and agonistic (fighting). The average percentage of *Long-tailed macaque* observed was feeding (9.4%), sleeping (9.4%), inactive (10.4%), grooming (10.4%), mating (8.3%), moving (11.5%), excretion (10.4%), playing (8.3%), making sound (12.5%), and agonistic/fighting (9.4%). To support the population of this species, especially for long-term survival, the manager of the Rinjani Nasional Park should preserve the forest with conservation of natural forests and wildlife or Biodiversity conservation and ecotourism, also prevent littering and illegal activities.

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