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Abstract. The Sumatran rhino is one of Indonesia's endemic species. The decreasing number of its population made the sanctuary project become more important to maintain the population's existence. Sumatran Rhino Sanctuary is one of the breeding projects to keep the existence of Sumatran rhinoceros. For successful management in a sanctuary, it is necessary to understand how wildlife daily behavior so it can be adjusted with any management steps that will be applied. The purpose of this research is to understand and to analyze the daily behavior of Sumatran rhinoceros in Sumatran Rhino Sanctuary at Way Kambas National Park. This research was conducted in July 2017. The data was collected by using Focal Animal Sampling and was analyzed with quantitative descriptive technique. The result showed that Sumatran rhinoceros behavior in the Sumatran Rhino Sanctuary was not significantly different from their natural behavior. The dominant behavior in the morning was feeding and at noon was resting, while the moving behavior constantly occurred between that behavior.

Keywords: behavior, focal animal sampling, Sumatran Rhino Sanctuary, Way Kambas National Park

1. Introduction

The Sumatran rhinoceros (*Dicerorhinos sumatrensis*) is one of the five existing species of rhinoceros in the world. Sumatran rhinoceros has the smallest body compared to another member of the family *Rhinocerotidae* [1]. Sumatran rhinoceros population now remains in Aceh, Lampung and South Sumatra only [2]. Sumatran rhinoceros is a very sensitive wild animal that likes to live away from the crowds and humans disturbance [3]. Sumatran Rhinoceros is one of the slow-breeding species that are highly prized by poachers. Their horns were highly demanded because of its use in traditional Chinese medicine [4]. The estimated number of Sumatran Rhinoceros varies considerably and this uncertainty is of great concern [5]. According to [6], the numbers of wild Sumatran Rhinoceros remained unknown despite evidence of a precipitous decline from several hundred individuals in 1984 to less than 100 in 2013. Poaching has been a causal factor in the decline of the Sumatran rhinoceros, which has also been affected by habitat loss and isolation [6,7].

Sumatran Rhino Sanctuary is a breeding center for Sumatran Rhinoceros that established in 1998 as a last effort to save the population from extinction [2]. The Sumatran rhinoceros is now Critically Endangered species according to International Union Conservation of Nature and Natural Resources

[8], with a decreasing population trend, and confined to a few disjunct populations in Indonesia and Malaysia [9]. The Sumatran rhinoceros is a good example to illustrate the challenges in the conservation of a highly endangered species [10]. Identifying the best strategy for conserving the Sumatran rhinoceros is a pressing concern of international conservation nowadays [11]. In order to support its conservation and preservation as well as its utilization is through breeding both insides (in-site) or outside (ex-site) its natural habitat. To formulate appropriate management measures in captivity, knowing the animal's daily behavior is important [12].

The knowledge about Sumatran Rhinoceros' daily behavior is not widely known. The results are expected to provide more detailed information about Sumatran Rhinoceros' behavior and its daily activities to perform effective management actions. The success of Sumatran Rhinoceros protection and conservation was determined by the manager's capability that has adequate education about Sumatran Rhinoceros behavior in order to know what the obstacle in its management) [3]. This research aimed to analyze how the daily behavior of Sumatran rhinoceros in SRS including eating behavior, resting behavior, and moving behavior.

2. Materials and methods

2.1. Study area

This research was conducted on 5-18 July 2017 at Sumatran Rhino Sanctuary Way Kambas National Park, Lampung Province, Indonesia (figure 1).

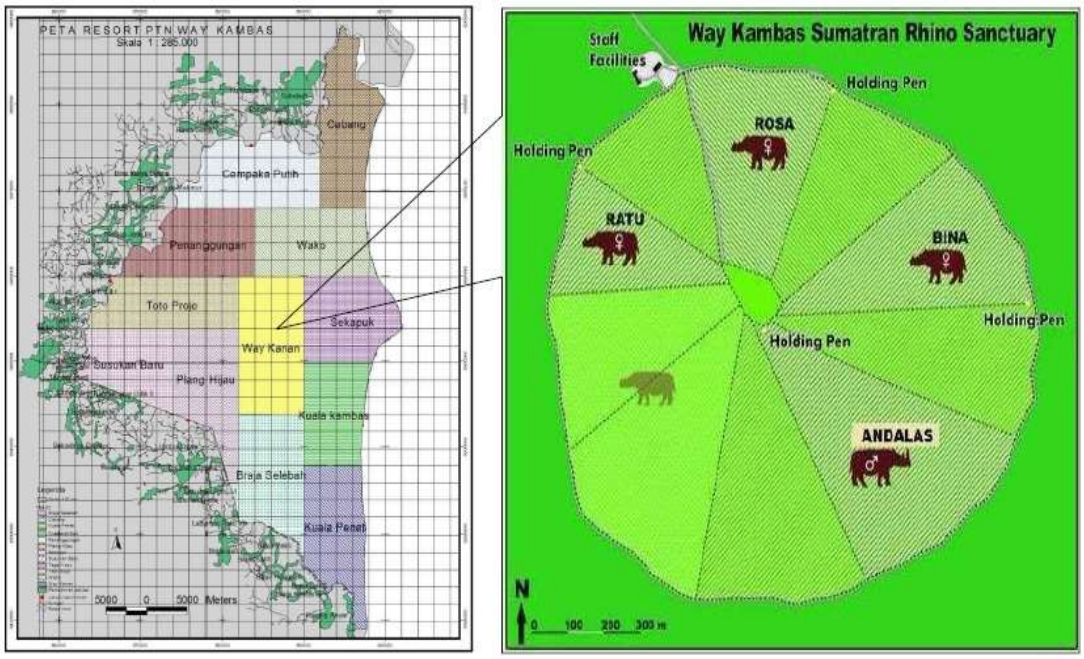

Figure 1. Location of research, Sumatran Rhino Sanctuary, Way Kambas National Park [13].

2.2. Procedures

Daily behavior data of Sumatran Rhinoceros was obtained using the Focal Animal Sampling method. In this sampling method, all of the actions of one animal are recorded for a specified time period [14] [15,16]. The collected data includes primary data and secondary data. Primary data is daily behavior data of Sumatran Rhinoceros classified in three major behavior which are feeding behavior, resting behavior, and moving behavior. Secondary data is supporting data in the form of books, journals, and

other literature. The tools used are a camera, binocular, watch, stationery, laptop, and tally sheets, while the research object is a female Sumatran Rhinoceros named "Ratu".

2.3. Data analysis

Data analysis using quantitative descriptive data analysis technique. Data processing is done by recording the daily behavior of Sumatran Rhinoceros. The data afterward tabulated using the calculation formula of the Focal Animal Sampling method [14,15,16] described in equation 1 and 2.

$$Activity\ Analysis = \frac{\text{Number of Activity}}{\sum \text{Total activity}}\ X\ 100\% \quad (1)$$

$$Time\ Analysis = \frac{\text{Time for each activity (minute)}}{\sum \text{Total Time (minute)}}\ X\ 100\% \quad (2)$$

The result of this calculation is the percentage of Sumatran Rhinoceros daily behavior. The explanation of Sumatran Rhinoceros daily behavior was analyzed descriptively.

3. Results and discussion

3.1. Results

Behavior observation was performed for 105 hours of observation within 14 days (± 7 hours of observation/day). Observations of Sumatran Rhinoceros daily behavior are divided into three categories: feeding behavior, resting behavior, and moving behavior. Feeding behavior involves activities such as chewing, swallowing, or put a part of animals or plants or other feed material into mouth [17,18]. Resting behavior involves activity such as lying, sleeping, and standing with head drooping down. Moving behavior involves walking, running, or jumping [19]. SRS applies a regional management system with a semi-in-situ concept. Rhinos are allowed to live as natural as possible in their natural habitat, although it is limited to an area of only 20-50 ha for each individual. The system applied is in accordance with the original nature of the animal.

Behavior dynamics is a pattern of activity changes that shows the highest frequency of activity at certain hours to represent the general trend of activity. The behavior dynamics was used to understand the time laps between behavior one and another. It can present the most occurred behavior at certain times, therefore the dominant behavior can be found. The dynamics of Sumatran Rhinoceros activity are presented in table form (figure 2) as follows.

Based on figure 2 the most dominant activity in the morning, 07.00-10.00 (GMT+7) is feeding activity because it was the usual time the rhino to get drop-in feed. In accordance with the statement [20] that eating behavior in the cage mostly occurs between 07.00-09.00 (GMT+7) with the average percentage of meal time of 57.5%. During the day 10.00-14.00 (GMT+7), the most dominant activity is resting activity because the Sumatran Rhinos love to wallow during the day to stabilize their body temperature. According to [19] states that at certain times around 11.00-13.00 (GMT+7) Sumatran rhinos will go to the wallow area to wallow. The most dominant activity in the afternoon, 02.00-16.00 (GMT+7) is resting activity because in the afternoon rhino had given additional drop-in feed around the wallow area, so when the feed necessity was fulfilled the rhino will soon return to the wallow.

The proportion time of daily activity is the allocation amount of time for each activity of feeding, resting, and moving based on rhino daily time (figure 3). The data was calculated then the percentage with the total daily time of the Sumatran Rhino started from 07.00-16.00(GMT+7). The percentage result was presented in graphical form (figure 3) as follows.

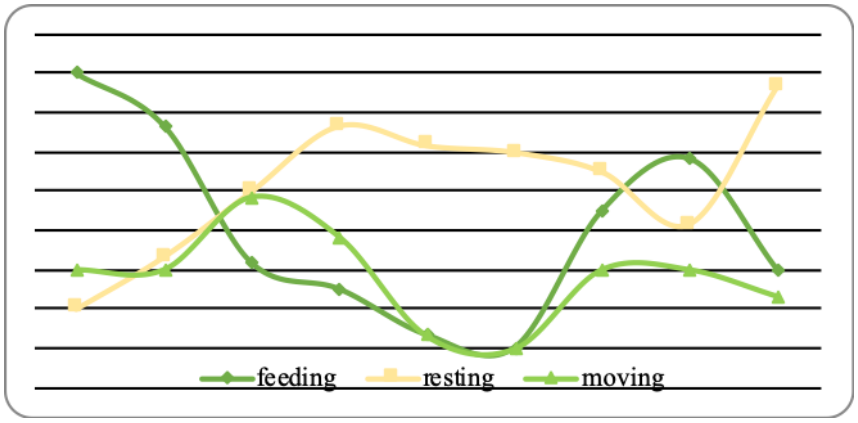

Figure 2. Dynamics activity per hours of Sumatran Rhinoceros "Ratu".

Figure 3. Percentage of Sumatran Rhinoceros "Ratu" daily behavior.

The percentage in figure 4 was obtained from the comparison of total feeding behavior time of 2,211 minutes, total time of resting behavior of 2,963 minutes, and total moving behavior time of 1,185 minutes with total daily behavior of "Ratu" starting at 07.00-16.00 (GMT+7), that is equal to 6,359 minutes.

3.2. Discussion

The Sumatran rhino has a different behavioral pattern compared to the other animal species. Based on research "Ratu" spent 35% of her total daily time for feeding behavior. The Sumatran rhino is basically a nocturnal animal so its feeding activity is more active at night [20]. The feeding behavior of the Sumatran Rhino in SRS was divided into drop-in feeding behavior and natural feeding behavior. Drop-in feeding was done twice a day in the morning 07.00-09.00 (GMT+7) and afternoon 13.30-14.30 (GMT+7). According to [21], rhinos get food by destroying, biting, and bending the tree feed with its horn, teeth, and legs. Sumatran rhino drop-in feeding behavior begins by walking to the source of feed, sniffing and snorting, then eating by biting the feed that has been provided.

Sumatran rhino is a natural browser animal. As long as the feed needs to be fulfilled, the Sumatran rhinoceros will stay for quite a long time. The Sumatran rhino's natural feeding behavior was by push the trunk of the feed tree and then step on the tree until it collapses to obtain the feed, sticking out its mouth and pulling the hanging roots off. Rhino also feeds nursling by twist or bite the plant stems to pick the leaves. When the Sumatran rhinoceros full, they will immediately be looking for a place to rest, either for wallowing or lying down.

Ratu spent 46% of her total daily time 07.00-16.00 (GMT+7) to do resting behavior. The resting behavior of the Sumatran Rhino in the SRS was divided into wallowing, standing still, sleeping, and lying down. Rhino resting behavior not always did by lying down, but also done while standing with head drooping down [19]. In summer, the Sumatran rhinoceros preferred to wallowing and lying down underneath the trees, bamboos, or open forest. The Sumatran rhino lies down or sleeps with one or both

legs stretching forward and lying down on the ground. Sumatran rhinoceros-like to wallow to cover their bodies with mud. Their wallowing area can be found in the area with a flat land with 2-3 meters in length. Sumatran rhinoceros also like to bath and wash their bodies with water to maintain the skin moisture. The Sumatran rhinoceros used to wallow once or twice a day for 2-3 hours [19]. The wallow spot of Sumatran rhinoceros usually located in cool and hidden areas [22].

The Sumatran rhinoceros was a solitary animal. It is hardly possible that two rhinos would walk together in the same path, unless when the mother taking care of its baby and also when the male comes to the female for breeding [23]. Sumatran rhinoceros used 19% of total daily time to do moving behavior. The moving behavior of Sumatran rhinoceros in SRS was divided into walking by stepping, running or jumping. The Sumatran rhino moves very slowly but remains alert to the surrounding circumstances. The rhinos will run or jump when they are disturbed or startled. The Sumatran rhinoceros regularly will follow the same path, especially the path near the wallow area. The moving behavior of every wildlife basically was influenced by two factors which were the factor that stimulates rhino to complied their physiology or hungry and thirst feelings [3]. Every animal will move to find their food and drink or for breeding [21]. The movement of Sumatran rhinoceros was also affected by weather conditions. At the rainy season, the river in the mountains will drain off to the lowland area, the Sumatran rhinoceros will leave the inundated area and look for the hills to make the puddles for wallow spot [20].

4. Conclusion

It can be concluded that based on this research, the feeding behaviour of Sumatran rhinoceros mostly occurred in the morning (AM) and the resting behavior mostly occurred at noon (PM). The moving behavior was constantly occurred during feeding and a moment to resting behavior. The suggestion for captive breeding is to make the rhino eating time effective by a giving variety of drop-in foods not only from feed supplies but also from the surrounding forest. The habit of eating food from the forest must be prioritized for Ratu.

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