

Daytime behavior of captive Malayan tapirs at Songkhla Zoo**Thanaphon Suwannaphong¹, Wanida Limmun², Saritvich Panyaboriban³, Manita Wittayarat³ and Naparat Suttidate^{1,*}**¹*Department of Biology, School of Science, Walailak University, Nakhon Si Thammarat 80161, Thailand*²*Department of Mathematics, School of Science, Walailak University, Nakhon Si Thammarat 80161, Thailand*³*Faculty of Veterinary Science, Prince of Songkla University, Songkhla 90110, Thailand*

naparat.st@wu.ac.th

Abstract

The endangered Malayan tapir (*Tapirus indicus*) has experienced a precipitous decline in population size recently, and may go extinct without effective conservation planning. However, a paucity of studies on tapir ecology and behavior hinders potential conservation efforts and management of populations. Our goal was to investigate daytime behavior of captive Malayan tapirs. We observed and recorded daytime behavior for six individuals (three males, two females, and one juvenile male) at Songkhla Zoo from May to June 2017. We found that Malayan tapirs spent most of their daytime in resting (>70%), including laying down, sitting, and sleeping. The rest of the day, tapirs allocate time between eating, bathing, and moving. Both social behaviors (<1%) and excretory behaviors (<1%) were rarely observed. Sexual behaviors were more common in male tapirs (0.83%) than female tapirs (0.28%). The juvenile tapir spent more time eating than adult tapirs. The female tapir with her juvenile spent more time moving and exhibited more social behavior than female tapir without offspring. This study provides better understanding of the daily activity and behaviors of tapirs in captivity with inference to their natural habits, and highlights the importance of proper zoo management in order to improve health and reproductive success for tapirs in captivity. This preliminary study of tapir behavior could potentially assist conservation planning in the future.

Keywords: Malayan tapir, Behavior, Captive animal, Daytime activity**Introduction**

The Malayan Tapir (*Tapirus indicus*) is an endangered species [1]. It is one of five tapir species in the world, and the only one found in Asia [2]. The range of Malayan tapir covers the Malay Peninsula and Sumatra regions. In Thailand, tapir populations are restricted to wildlife sanctuaries and national parks in western and southern Thailand [3, 4]. Tapirs mostly occupy lowland evergreen forests in the South [4]. Currently, populations are decreasing due to low reproductive rates, habitat loss, and habitat fragmentation. Despite precipitously declining populations, the limited number of ecological and behavioral studies hinders conservation efforts and management planning for Malayan tapirs.

Malayan tapirs are solitary and nocturnal [5]. They only commune around salt licks and stay as couples only in the breeding season [5]. Tapir's gestation is about 13 months, and typically with a single offspring being born every two years. Female tapirs take care of their young for at least six to eight months [6]. Many studies of tapir behavior in wild areas show that tapirs are nocturnal species [3,7,8]. Brazilian tapirs (*Tapirus terrestris*) are active between 18:00 h and 07:00 h. They reduced their displacement around midnight to concentrate their foraging activity [7]. Captive Brazilian tapirs in the zoo are visible to the public less than 15% of the time during the day and maintain their nocturnal habits [9]. Brazilian tapir populations in the Amazon tend to live isolated, even from related individuals [10]. Malayan tapirs in the Taratak forest

reserve in Sumatra, Indonesia forage at night especially at 22:00h [8]. Although pattern of tapir behaviors in captivity and the wild show mostly nocturnal activities, behaviors vary widely among study sites, and based on environmental factors, such as vegetation, climate, topography, and human disturbance [3,7,8,9,10]. However, the daytime behavior of Malayan tapirs in captivity has not yet been studied. Understanding of Malayan tapir behavior would provide information for management, potentially improving reproductive success in captivity.

Our goal was to investigate the patterns of daytime behaviors of Malayan tapirs in captivity, with the following objectives: 1) To study daytime behaviors of Malayan tapirs in the Songkhla Zoo, Thailand and 2) To compare the patterns of behaviors among Malayan tapirs at the Songkhla Zoo.

Materials and Methods

Malayan tapirs in the Songkhla Zoo

The Songkhla Zoo is the largest zoo in southern Thailand (100.6042, 7.1430). The zoo emphasizes public education and reproductive research for endangered species in Thailand. We observed six individuals at the Songkhla Zoo: three male tapirs, two female tapirs, and one juvenile, male tapir. One male and one female are housed as a mating pair in the wildlife nursery unit with an area of 675 m², while the other four individuals are housed in the exhibition unit. The exhibition unit is separated into three sub-areas: one for each of the two male tapirs and one for female tapir with her offspring. The wildlife nursery unit is quieter than the exhibition zone, because it is isolated from the public. Distinct characteristics were used to identify individual tapirs (Table 1).

Table 1 Individual tapirs at the Songkhla Zoo, Thailand.

No.	Tapir Code	Age (Years)	Sex (F/M)	Description
1	S1	17	F	Clipped left ear, long straight wrinkles along the body
2	S2	6	M	Usually flicks legs before walking, concave line in the middle of the back
3	S3	12	F	Two clip marks on right ear, scratch wound along the body
4	S4	8 months	M	The juvenile male tapir always lives with S3
5	S5	4-5	M	Smaller than S6, always lives in the enclosure
6	S6	10	M	Always stays within the home range behind S5's home range

Animal behavior sampling

We employed the Malayan tapir ethogram based on previous studies of tapir behavior [9]. The ethogram was used to record behavior data systematically [11]. We observed and recorded all behaviors of the six tapirs for 24 days between the 15th of May, 2017 and the 27th of June, 2017. We used the focal animal sampling method, observing one target individual at the time and recording all expressed behaviors throughout the sampling time period. Data provided both frequency and duration of expressed behaviors (in seconds) [11]. We observed tapir behaviors from 9:00 to 12:00 and 13:00 to 16:00 by recording behavior one hour for each tapir, then observing the next tapir sequentially in the second hour until the last tapir was recorded. On the following day, the recording was repeated, but starting with the second tapir (S2) (Table 2). This sampling method reduces any variation in behavior due to the time, weather, or other factors. In each hour, we also

recorded environmental data, including temperature, humidity, wind velocity, and descriptive weather conditions (i.e., sunny, partially cloudy, cloudy, or raining).

Table2 Data collection design showing focal animal sampling method.

	9:00-10:00	10:00-11:00	11:00-12:00	13:00-14:00	14:00-15:00	15:00-16:00
Day1, Day7, Day13, Day19	S1	S2	S3	S4	S5	S6
Day2, Day8, Day14, Day20	S2	S3	S4	S5	S6	S1
Day3, Day9, Day15, Day21	S3	S4	S5	S6	S1	S2
Day4, Day10, Day16, Day22	S4	S5	S6	S1	S2	S3
Day5, Day11, Day17, Day23	S5	S6	S1	S2	S3	S4
Day6, Day12, Day18, Day24	S6	S1	S2	S3	S4	S5

Data analysis

We classified behaviors into seven categories (Table 3) [9]. The data included behavior durations from 9:00 to 12:00 and 13:00 to 16:00 of six tapirs, four replicates for each tapir. We summarized tapir daytime behavior by averaging four replications of the behavior time durations in each category for each tapir. Then, we calculated the percentage of time an individual spent for each behavior throughout our observation. Additionally, we compared the daytime behaviors for all tapirs among the group of male and female tapirs. Finally, we compared our results with the differences between tapir behaviors in captivity and in the wild from previous studies.

Table 3 Ethogram of Malayan tapir behavior at the Songkhla Zoo, Thailand.

No.	Category	Behavior
1	Resting behaviors	Sitting, Lying Down, Sleeping
2	Feeding behaviors	Eating, Drinking
3	Entertaining behaviors	Bathing, Rubbing
4	Moving & Posture behaviors	Walking, Standing
5	Social behaviors	Affiliation, Aggressive, Offspring care
6	Sexual behaviors	Courtship, Extending penis
7	Excretion behaviors	Defecate, Urination

Results

Tapir behavior in the Songkhla Zoo

Malayan tapirs at the Songkhla Zoo spent most of the day resting (40.20%-79.70%) (Figure 1). Among resting behaviors, tapirs spent the most time sleeping (67.88%). The resting behavior for each tapir varied depending on their locations and individual habits. The two male tapirs (S5 and S6) in the exhibition unit and the mating pair (S1 and S2) in the wildlife nursery unit spent the highest proportion of time resting, approximately 70% in comparison to the female tapir and her offspring (S3 and S4). The two male tapirs (S5 and S6) in the exhibition unit usually walked away when people visited, indicating that they were not familiar with people. They were more likely to spend time in a quiet place to hide from people and relax rather than doing any activities. Other tapirs in the exhibition unit, the female tapir (S3) and the juvenile male tapir (S4), spent less time resting (40.20% and 43.30%, respectively). The female tapir (S3) and the juvenile male tapir (S4) usually approached tourists, and requested food from by walking toward them and raising their noses.

When not resting, individuals spent their time in moving and posture behaviors (8.61-22%) (Figure 1). Tapirs mostly moved when they needed food. They walked and sniffed around their cage to find food or approached people to ask for food. Tapirs spent time to eat (9.97-13.6%) during the day. Eating time varied depending on several factors, such as amount of food from the zookeepers and the type of food. The proportion of time tapirs spent for entertaining behaviors varied widely among individuals (0.28 -16.3%).

Interestingly, the female tapir (S3) and the juvenile tapir (S4) spent the highest proportion of their time bathing (16.30% and 15.80%, respectively) in comparison to other tapirs because these two tapirs were familiar with people. Moreover, social behaviors were only found in the female tapir (S3) and the juvenile tapir (S4) (4-7%). Most of the social behavior was related to juvenile care activities e.g., breast feeding. Both male tapirs (S5 and S6) demonstrated no social interactions with other tapirs, and were more likely to spend time in their own home ranges. The pair of tapirs in the wildlife nursery unit (S1 and S2) did not show any social behaviors, because their social interactions were categorized as sexual behaviors.

For sexual behaviors, male tapirs display their extended penis, which can occur at any time of the day. Since tapirs are nocturnal species, tapirs may display other sexual behaviors at night or twilight. For excretory behaviors, they mostly defecated in water and sometimes on the ground, often at the same place. Tapirs sprayed urine for a short time rather than continuously releasing urine.

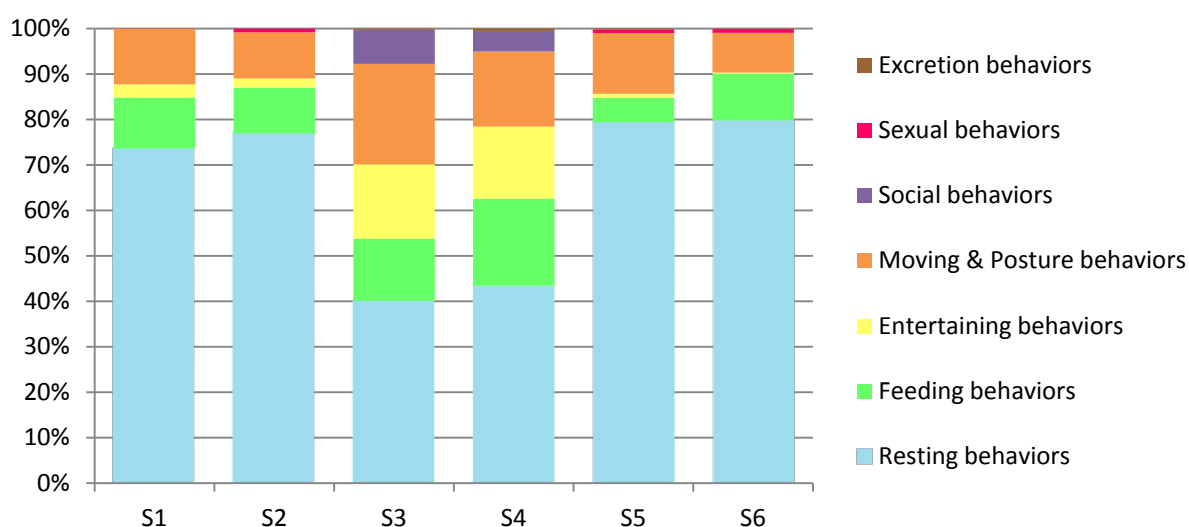


Figure 1 The percentage of time spent for seven groups of behaviors of six Malayan tapirs at the Songkhla Zoo, Thailand.

Comparison among male, female, and juvenile tapirs

We found that the male tapirs spent the highest proportion of their time resting in comparison to female and juvenile tapirs. The juvenile tapir (S4) showed moving and posture, entertaining, and feeding behaviors more than other tapirs did. The juvenile tapir required more energy and had poorer eating skills than the others, thus it spent more time eating, while the male tapir (S5) spent the lowest proportion of time for feeding.

The female tapir with her offspring (S3) tended to move and had more social behaviors than the female tapir without offspring (S1). Sexual behaviors mostly occurred in adult male tapirs. However, the sexually active female would smell and nuzzle the male. Sexual behaviors were not found in the female tapir that lived without a male (Table 4).

Table 4 Comparison daytime behaviors for male, female, and juvenile Malayan tapirs at Songkhla Zoo, Thailand.

Daytime behavior	Male	Female	Juvenile
Resting behaviors	78.63%	56.87%	40.17%
Feeding behaviors	8.51%	12.34%	13.57%
Entertaining behaviors	1.02%	9.57%	16.34%
Moving & Posture behaviors	10.73%	17.20%	22.16%
Social behaviors	0.00%	3.74%	7.48%
Sexual behaviors	0.83%	0.14%	0.00%
Excretion behaviors	0.28%	0.14%	0.28%

Discussion

The results show that Malayan tapirs at the Songkhla Zoo, Thailand spent most of their daytime activities in resting. Our results are similar to other studies demonstrating the nocturnal behavior patterns of tapirs in both captivity and nature [3, 7, 8, 9]. In camera trap studies, Malayan tapirs are more active at night and early morning [3, 8]. Captive Brazilian tapirs in the zoo also spent less time out during the day [9]. Additionally, sexual behaviors are more likely to be expressed at night or twilight rather than daytime [3, 8]. Furthermore, social behaviors were rarely found in captivity and in the wild because tapirs are solitary species [5, 10]. Malayan tapirs in captivity have different behavior patterns than those in the wild due to captivity management and human activities. In captivity, tapirs get fed in the day instead of foraging at night. Tapirs in captivity are more familiar with people. They show moving and posture behaviors more than tapirs in the wild to ask for food from tourists or respond to zookeepers. Our results highlight the importance of daytime behavior patterns for providing a better understanding of how tapirs in captivity respond to human activities and how they behave differently from tapirs in the wild. The results could also assist zoo managers to improve the living conditions for tapirs which could improve quality of life and reproductive success. For example, clean water bodies are important because captive tapirs defecate and bathe in the same water body. Captivity areas should have a low human disturbance zone to promote breeding behavior. Additionally, our results could be applied for tapir study designs in the wild. For instance, field surveys could be located near water bodies and focus on early morning and nighttime activities. Importantly, our preliminary results on daytime behaviors can be used as baseline information for further conservation planning of Malayan tapirs in the wild.

Conclusions

Our daytime behavior study of Malayan tapirs in captivity at the Songkhla Zoo, Thailand provides insight into tapir behavior in captivity with inference to their natural habits. Our results can be applied to improve zoo management in order to maintain healthy captive populations of endangered tapirs. Specifically, understanding daytime behavior could assist veterinarians and zoo managers to plan breeding strategies, increasing successful reproduction, and potentially curbing natural population declines in the future.

Acknowledgements

We would like to thank Walailak University and the Development and promotion of science and technology talents project (DPST) for funding. Special thanks to Dr. Phuwadon Suwanna, DVM, the head of Conservation Research and Animal Health Department, as well as the researchers and staff from the Songkhla Zoo for assistance and support during conducting field work. We also thank the anonymous reviewers for their input.

References

- [1] C Traeholt, W Novarino, S bin Saaban, NM Shwe, A Lynam, Z Zainuddin, B Simpson, S bin Mohd. *Tapirus indicus*. The IUCN Red List of Threatened Species, 2016.
- [2] MA Cozzuol, CL Clozato, EC Holanda, FH Rodrigues, S Nienow, B de Thoisy, RA Redondo RA, FR Santos, A new species of tapir from the Amazon. *Journal of Mammalogy*, 2013; 94(6), 1331-1345.
- [3] AJ Lynum, N Tantipisanuh, W Chutipong, D Ngoprasert, MC Baker, PCutter, G Gale, S Kitamura, R Steinmetz, R Sukmasuang and S Thunhikorn. Comparative sensitivity to environmental variation and human disturbance of Asian tapirs (*Tapirus indicus*) and other wild ungulates in Thailand. *Integrative Zoology*, 2012; 7, 389-399.

- [4] B Kanchanasaka. Habitat use and population of tapirs in Thailand. *Wildlife Yearbook*, 2015; 15, 43-56.
- [5] KD Williams. Browse use, feeding behavior, and management of the Malaysian tapir. *Journal of Wildlife Management*, 1980; 44(2), 489-494.
- [6] S Thunhikorn. Habitat utilization of malayan tapir (*tapirus indicus*) in Khlong Saeng wildlife sanctuary, Surat Thani province. Master thesis, Kasetsart University, Bangkok, Thailand, 2003.
- [7] P Cruz, A Paviolo, RF Bó, JJ Thompson, MS Di Bitetti. Daily activity patterns and habitat use of the lowland tapir (*Tapirus terrestris*) in the Atlantic Forest. *Mammalian Biology*, 2014; 79(6), 376-383.
- [8] W Novarino. Population monitoring and study of daily activities of Malayan tapir (*Tapirus indicus*). Report to Rufford Small Grant (for Nature Conservation) in Association with the Whitley Laing Foundation, 2005; 14, 28-30.
- [9] LML Dutra and RJ Young. Can enrichment make Brazilian tapir spend more time on view to the public? *Journal of Applied Animal Welfare Science*, 2015; 18(1), 74-81.
- [10] GM Pinho, AGD Silva, T Hrbek, EM Venticinque and IP Farias. Kinship and social behavior of lowland tapirs (*Tapirus terrestris*) in a central Amazon landscape. *PLoS ONE*, 2014; 9(3).
- [11] J Jetjaroen. How to record animal behavior and data analysis at Khao Kheow Open Zoo. The training materials, Department of Resources and Environment, Faculty of Science, Sriracha Campus, Kasetsart University, 2016.