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Daily Behavior of Bangla Tigers *(Panthera tigris tigris)* in Ex-situ Conservation Site, Serulingmas Zoo, Banjarnegara

Aswi Andriasari Rofiqoh[1*], Siti Rukayah[2], Erie Kolya Nasution[2], and Ridha Nabila Priyani[1]

[1]*Laboratory of Animal Taxonomy, Faculty of Biology, Universitas Jenderal Soedirman, Purwokerto*
[2] *Laboratory of Ecology, Faculty of Biology, Universitas Jenderal Soedirman, Purwokerto*

* Email: aswi.ar@unsoed.ac.id

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Abstract

Panthera tigris tigris is a subspecies of *Panthera tigris*, which originates from India and has been declared an endangered species. Bengal Tigers are facing a severe decline in their habitat and population. Ex-situ conservation of *Panthera tigris tigris* has been done in some Indonesian zoos to enhance its population. Serulingmas Zoo is one of the ex-situ conservation sites. This study aims to observe the tigers' daily behavior in captivity as a conservational database. Behaviors of Bangla tigers (*Panthera tigris tigris*) in captivity were investigated from February to March 2021 in Serulingmas Zoo, Banjarnegara. Instantaneous Focal animal sampling has been conducted to observe the seven tigers. The results showed that the behavior could be divided into Moving, feeding, resting, social and other behaviors (including drinking, urinating, grooming, stretching, and defecating). The daily behavioral patterns showed resting behaviors as the most significant (33.56 %). The pacing activity (24.43%) counted as a frequent one that showed the tigers had altered their natural behavior. The eating and social 16.42%, and 13.03%), respectively. Defecating was reported as a minor activity (0.22%). Generally, the daily behaviors of Bangla tigers captivated at Serulingmas zoo showed the alteration behavior pattern.

Keyword: Behaviour, Ethogram, Ex-situ, *Panthera tigris tigris*, Serulingmas Zoo

INTRODUCTION

The Bangla tiger is one of nine subspecies of *Panthera tigris*. This subspecies originates from India and has been declared an endangered species (Goodrich, 2004). The endangered Bengal tiger (*Panthera tigris tigris*) is the second biggest tiger and one of the top predators of the forest *(De et al., 2019)*. Male Bangla tiger in the wild usually weighs 205 to 227 kg (450–500 lb), while the average female will weigh about 141 kg (Goodrich, 2004). This population has dropped by 60% in the past decade from 2000 to 1411, caused by poaching and decreasing habitat. Massive in-situ and ex-situ conservation actions have been conducted to improve the Bengal tiger population (Goodrich, 2004; *Kolipakam et al., 2019;* Mohapatra & Sethy, 2020).

Zoological parks (zoo) has a significant role in the conservation of wild animal through captive breeding, research, and education (Mohapatra & Sethy, 2020; Phillips & Peck, 2007) *(*Gomes *et al., 2019)*. The appreciation for endangered species has been developed by introducing the animal to the public to enhance their conservation. The zoo collections are essential in ex-situ conservation breeding as a potential source of animals for future reintroduction attempts (Pastorino *et al., 2017)*. Serulingmas Zoo is one of the ex-situ conservation sites of *Panthera tigris tigris*. Serulingmas has seven Bengal tigers in their collection. The *Panthera tigris tigris* Ex-situ

conservation at Serulingmas zoo faces various challenges as it is not native species. The captive and husbandry conditions are demanding Bangla tigers to adapt to the new environment.

Individuals kept in captivity may show a gradual change in behavior as a form of adaptation *(Mohapatra et al., 2014; Biolatti et al., 2016; Biolatti et al., 2021)*. Animal behavior is defined as any movement carried out by animals as a result of the environment. The difference in living patterns between captive and wild could cause an inadequate adaptation. It poses a major challenge, as animal stress could suppress cognitive functioning and increase stereotypic behavior (Mohapatra & Sethy, 2020; *Mohapatra et al., 2014)*. Observation of animal behavior is used to diagnose behavior changes that might be beneficial or detrimental. Early detection of behavioral changes may prevent the unwanted changes from being permanent. Thus the observation of Bangla Tiger at Serulingmas ex-situ conservation site needs to be done to obtain data on its daily behavior and adaptation factors at captivity to enhance their survival rate as a conservation effort.

METHOD

Study site and Subject

The study was conducted in Serulingmas Zoo, Banjarnegara (7°23'25.6"S 109°41'12.8"E) from February to March 2021. The observation took place at the Bangla tiger enclosure area. The Bangla tiger enclosure area consists of 9 tiger's stalls, two display places surrounded by a pond, and an office for the keepers, as shown in Figure 1. Seven Bangla tigers, namely Aji, Upi, Darma, Rasti, Darmo, Sembara, and Rastaji, kept in Serulingmas Zoo have been observed. Upi (11 yo) and Rasti (7 yo) are the female tigers, and during the observation, Upi was pregnant. The social behavior between tiger pairs (Darma-Upi, Aji-Rasti) has been recorded when both were exhibited together. Only one tiger being displayed in every exhibit per day, besides the couple and cubs. The Twin cubs, Sembara and Rastaji (1 yo), were displayed together, and the interaction between them has been observed too.

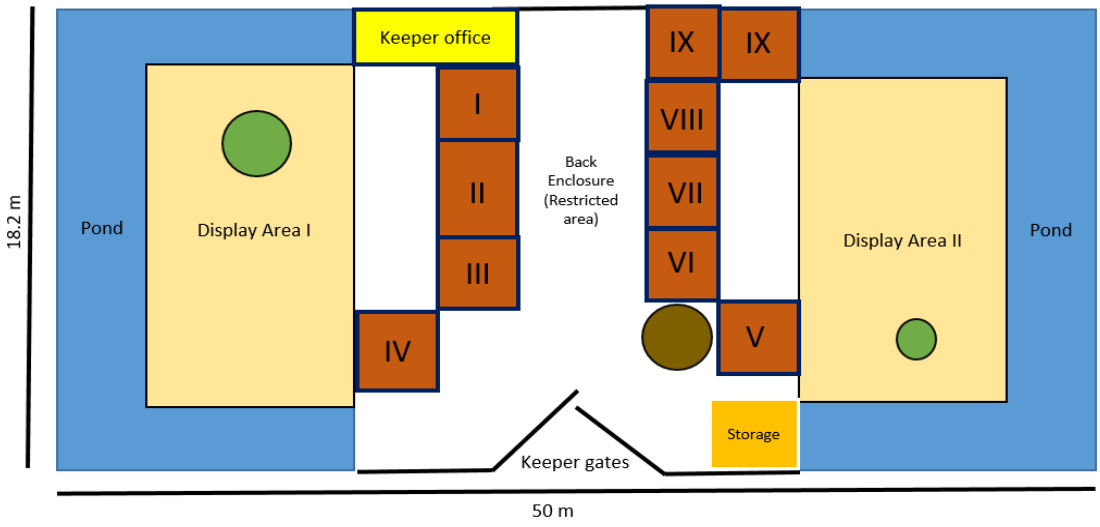

Figure 1. Tigers Enclosure.
Note: The green circle is the tree that provides shade for the tigers during the exhibition.

Tabel 1. Tigers Studied at Serulingmas Zoo

Code	Name	Gender	Birth	Father	Mother	Location (zoo)	Date	Explanation
101	Aji	M	16/09/2011					
102	Upi	F	16/09/2010					
103	Darma	M	01/11/2014			Semarang Serulingmas	 15/05/2019	Born Moved
104	Rasti	F	01/11/2014			Semarang Serulingmas	 15/05/2019	Born Moved
105	Darmo	M	01/04/2020	103	102	Serulingmas		Born
106	Sembara	M	27/07/2020	101	104	Serulingmas		Born
107	Rastaji	M	27/07/2020	101	104	Serulingmas		Born

Serulingmas zoo has seven tigers which are divided into two groups. This grouping has been made due to the effort to give a territory scheme to tiger's ecosystem. The Groups were defined based on the family trait and the display enclosure. The first group consists of Darma, Upi, and Darmo, which have the same family trait. Aji, Rasti, Sembara, and Rastaji were the second ones. Tigers were displayed individually in every exhibition, besides the couple and cubs. One male tiger was displayed at every exhibition per day to prevent any fights as the tiger is solitary and very strict about its territory.

Data Collection Method

The study was carried out using Instantaneous Focal Animal sampling to observe the seven tigers (Mohapatra & Sethy, 2020; Mohapatra *et al., 2014;* Lehner, 1992). Manual direct observation of the tiger's daily behavioral patterns began from 06:00 AM to 5:00 PM. Data was collected during the exhibition time. Data of behavioural types, the duration of each instance, and the frequency of specific behavior during the observation period have been collected according to the (Stanton *et al., 2015)* with modification. The modification was made by adding several behavioral types, which not mention in (Stanton *et al., 2015).*

Data Analysis

The observation data has been analyzed by classifying tigers behavior into ten behaviour types. The behaviours have been catagorize by three aggregate, namely resting, active and stereotypic behaviour. Data analysis was completed using Microsoft excel 2013 and IBM Statistical Package. Due to the small sample size, most tests for statistical significance showed insignificant results and were inappropriate. Therefore the analysis has been done descriptively. Ethogram has been constructed by comparing individual behavioral

types to total tiger behavior per defined time. Data is shown by calculating the percentage of frequency of activity behavior (Sunquist, 1981).

RESULT AND DISCUSSION

Tiger's Daily Behavior

Ten behavioral types of the seven tigers have been recorded. The Cubs (Rastaji, Sembara, and Darmo) showed less behavior type than the adult males. Resting is the most dominant behaviour than other one. **Figure 2.** shows the behavioral differences between the individuals in Adult tigers. Upi only exhibits five behaviors as she became more inactive during pregnancy. The tigers are carnivorous and were fed at times ranging from 12.00 to 13.00 and were fed six days a week with raw meat or chicken. During feeding time, tigers were restless and actively moving around the enclosure. The aggressiveness increased, and the tiger became active.

The social behavior between Darma and Upi showed different circumstances to Aji and Rasti. Pairs showed social behaviour as described on **Figure 2**. Darma showed agonistic behaviour more frequenly The cubs was also showed a lot of interaction as social behaviour. The interaction between the sibling was mostly showed as play behaviour.

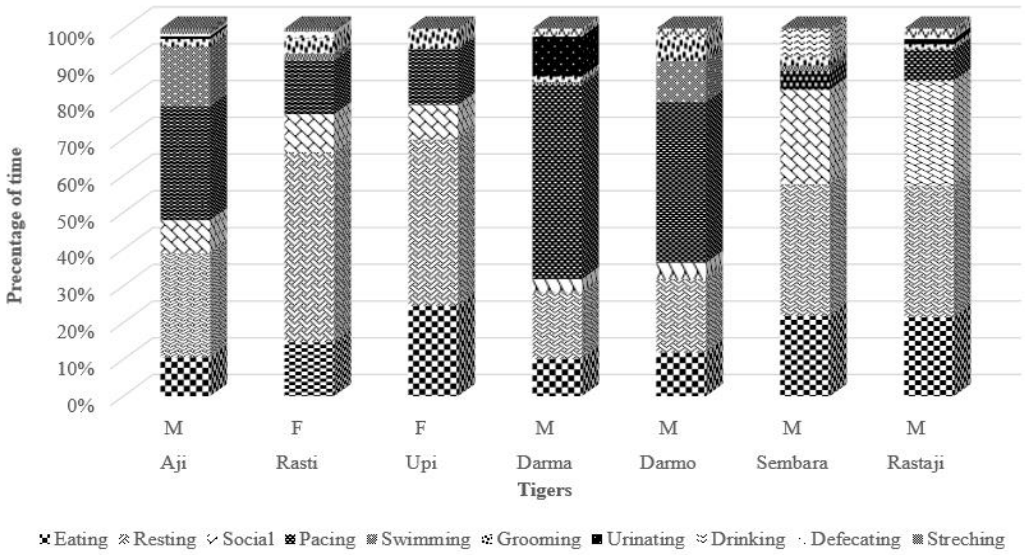

Figure 2. The Behavioral Type of the Serulingmas Tiger

Ethogram of Serulingmas Tigers

Ethograms have been developed regarding specifying the needs of tiger times based on their gender group. This ethogram (**Figure 3.**) showed comparative activity pattern of Bengal Tigers. Resting was the most dominant activity of Cubs and Female tigers. Pacing behaviour or moving behaviour has been the most activity recorded for male Tigers. The least activity of all category was drinking, streaching and urinating.

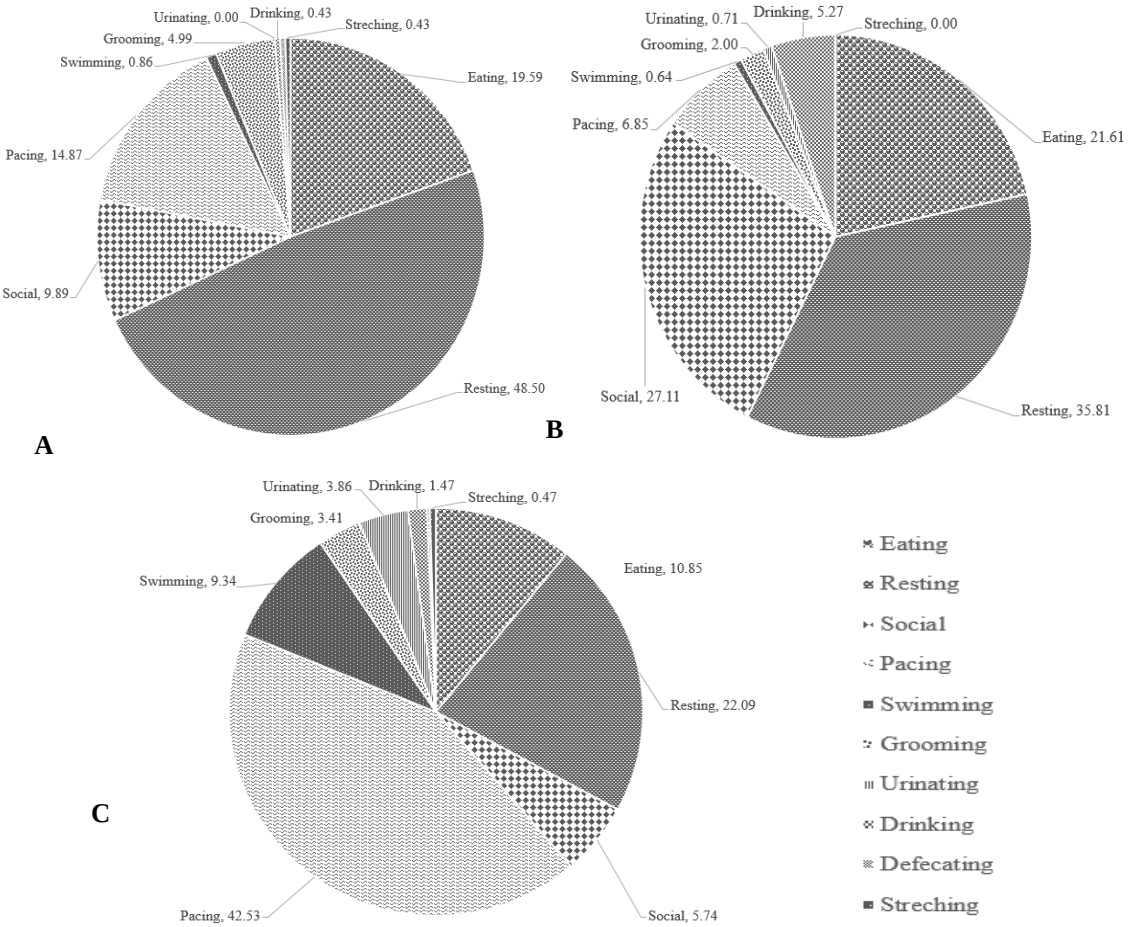

Figure 3. Time Budget of Female **(A)**, Cubs **(B)** and Male **(C)** Bangla Tigris

DISCUSSION

Tiger's Daily Behavior

The male tigers were the most active than the others. The pacing behavior with restlessness was observed around the feeding time, the tiger became more active and tried to get their feed. (De *et al., 2019;* Mohapatra & Sethy, 2020; Stryker *et al.* 2019) stated that tigers produced agonistic behavior during feeding time. Besides feeding time, tigers tend to become inactive and rest most of their time during the observation period. The sleeping posture was varied (Mohapatra & Sethy, 2020), and following is the sleep posture found in the Serulingmas tigers: lying flat on one side on the ground, arching the back, lying flat on one side with chest and abdomen upward.

Pairs showed the strongest links in both the affiliative and agonistic social networks (Semiadi & Nugraha, 2006; Stryker et al. 2019). Their relationship could be somehow associated with reproductive interests thus during the observation period the couple was expressing reproductive behaviors and also social behaviour as described on *(*Pastorino *et al., 2017;* Semiadi & Nugraha, 2006; Stryker *et al.* 2019). Darma showed agonistic behaviour more frequenly while Upi's pregnancy is being assumed as the cause of this phenomenon. The pond surrounding the display cage was very helpful for the tigers to help them reduce the temperatures, and Upi spent the most time swimming in the pond to make her comfortable during her pregnancy.

Cubs consist of the twins showed social behaviour as intense as the female group. Cubs were more playful than other age groups (9.89%) (**Figure 3.)**. Cubs did not exhibit stereotypic pacing behavior during the study period. Similar observations were reported by (Mohapatra & Sethy, 2020; Mohapatra *et al., 2014)*. The previous study stated that the development of stereotypical behavior in zoo-born captive tigers started when the tiger reaches 1.5 years old age (Mohapatra & Sethy, 2020). Improving the age and body size of the cubs, spatial constraints may exert more restrictive pressure on these tigers and alter their behavioral

repertoire to include stereotypical behaviors like pacing. Urinating and drinking were two unrecorded behaviors on the cubs.

The Male group's social behaviour was the most minor compared to other groups (5.74%). Urinating (5.67%) as the form of marking behavior occurred more frequently in the male group. Its presence to marking the territory and dominance of male individuals. The differentiation of diplaying period of the two groups has been made to reduce the conflict of the two alpha male. It is also being the reason for the male individual did more urinating as the activity of marking behaviors expressing their territorial and social nature (De *et al., 2019;* Pastorino *et al., 2017)*. Besides urinating, defecating was recorded as the minor behavior of all the groups. Results showed the stereotypical had been found in captive Bangla tigers, and this research could be used as a baseline for further studies regarding stereotypical adaptation in captive Bangla tigers.

Wild Bengal tiger is a nocturnal animal and tends to be active at dawn than on the days (Melfi, 2009). Some studies stated that tigers were only active during the day when they were preying. Captivation forces them to be active during the day. This difference made some tiger showed different behavioral patterns. Pacing, including walking back and forward, doing miscellaneous activities, was recorded has been done by the tigers. This behavior could be a sign of initiation of modification in stereotypic behaviour *(*Mohapatra *et al., 2014),*. Captivity undoubtedly alters tiger's behavior. It modifies their behavior as the result of the adaptation to best fit their environment.

Animals in captivity have less or no control over the external factors to which they are exposed to. The external variables influence tiger activity patterns or behavior. Some previous studies (Mohapatra & Sethy, 2020; Gomes *et al.,* 2019*;* Stryker *et al*. 2019) showed that environmental enrichment in captive conditions could help reduce behavioural stress and improve survival rate. Delay in feeding caused pacing behavior in tigers with aggressiveness and insecurities. Small enclosures caused tiger to pace more frequently than those in larger enclosures.

The Female and cubs data showed that enclosure size was negatively linked with pacing behavior. This finding agrees with those of *(*Gomes *et al.,* 2019*;* Acharjyo *et al.,* 2000*)* but is in contrast with the results of *(*Kusmarani *et al., 2019)* who observed that the total size of enclosures was not a major factor in pacing activity. On the other hand, enclosure size was not linked with indicators of enhanced welfare.

Ethogram of Serulingmas Tigers

The ethogram (**Figure 3.**) could be a model of population projection to interpret and inform conservation behavior of the possible consequences of anthropogenic stressors (Sunquist, 1981; Kurniawan dkk., 2021*)*. Run, swim, climb trees, hunt, and do other activities are the wild tiger usually does in their habitat. Wild tiger has wide-ranging in nature and stereotype. Tiger's stress is triggered by enclosure size. Tiger's behaviors could be seen by their activities shown in Figure 3. In their nature, resting (sleeping with various postures) was the highest time spent by the Male and Cubs tigers than the Male group. The male group spent the highest proportion on pacing. (Gomes *et al.,* 2019; Pastorino et al., 2017; Mohapatra *et al., 2014;* Lehner, 1992; Melfi, 2009) mentioned that pacing activity on captive tigers and Felidae are a sign of stress or insecurity. The result shows Male tigers have shown a pacing behavior higher than other groups. As a group leader, Male tigers showed pacing activity as they patrolled and defended their territory (Pastorino *et al.,* 2017*),*. The activities, including in normal pacing form (back-forward walk), are also mentioned as a stereotypic behavior that needs to be reduced before rehabilitation releases to the wild. The addition of cage size has been proved to reduce tiger stereotypes. The existing zoos with enclosures smaller than suggested by CZA need to enlarge their size. The exposure of the tigers to the visitors was also the cause of the male tigers felt insecure and develop pacing behaviour (Mohapatra & Sethy, 2020).

CONCLUSION

The behavior ethogram of Serulingmas Bangla tigers provides insight towards behavioral trends of captive Bangla tigers. The observation revealed stereotypical adaptation tendencies in the Bangla tiger subject. More subjects may generate enough data to predict behavioral trends among individuals, among age groups, and between sexes in future research. Resting, Pacing, and Social behavior was the most major behavior showed by Serulingmas Bangla tigers. Defecating was the minor one. Generally, the daily behaviors of Bangla tigers captivated at Serulingmas zoo have an alteration behavior pattern.

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