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Community Structure and Social Interaction of Timor Deer (*Cervus Timorensis*) in Tasikoki Animal Rescue Center, Bitung City, North Sulawesi

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Abstract: The Timor Deer (*Cervus timorensis*) is an endemic species of Indonesia classified as vulnerable by the IUCN due to deforestation, habitat degradation, and poaching. As a social animal, the community structure and dynamics of Timor Deer interactions influence reproductive success and population sustainability. The Tasikoki Wildlife Rescue Center (PPST) in Bitung City, North Sulawesi, is an ex-situ conservation facility that houses and rehabilitates Timor Deer as part of efforts to conserve this protected species. This study aims to analyze the community structure and describe the daily social interactions of Timor deer at PPST. Observations were conducted over 10 days using the focal animal sampling method for 12 hours per day (06:00–18:00 WITA) on a single group consisting of 21 individuals. The results of the study indicate that the community structure of Timor deer at PPST consists of 21 individuals divided into three age categories: 6 adults, 9 sub-adults, and 6 juveniles, with a male-to-female ratio of 1:1.14. One dominant male was identified as the alpha (Individual A), who leads the group and has priority access to food and females. The resulting social hierarchy reflects the natural patterns of *Cervus timorensis*, characterized by a linear dominance system. Daily social interactions within the Timor deer community at PPST were dominated by agonistic behaviors, totaling 27 incidents (51.9%) including fighting, chasing, chasing away, threatening, and butting as well as affiliative behaviors, totaling 25 incidents (48.1%) including grooming, following, and copulation attempts. Agonistic behavior was triggered primarily by competition for food access, whereas affiliative behavior occurred more frequently between adult females and juveniles, reflecting the pattern of collective care within the group.

Keywords: Timor deer; community structure; ex-situ conservation; social interaction

Introduction

Deer are part of Indonesia's biodiversity and belong to the ruminant order Artiodactyla, family Cervidae (Dewi et al., 2019). The Timor deer is a native Indonesian species widely distributed across the Nusa Tenggara region, Bali, and several translocation sites such as Sulawesi and Papua.

Pressures on natural habitats such as deforestation, land fragmentation, and poaching have caused the populations of Indonesia's endemic wildlife to continue declining. According to Rumakar et al. (2019), the populations and habitats of several endemic species, such as the Timor deer (*Cervus timorensis),* have shown a significant decline, indicating the presence of ecological pressures that must be addressed immediately.

Various efforts to protect and conserve the Timor Deer (*Cervus timorensis*) and its habitat have been implemented through government regulations. However, threats and disturbances persist due to habitat loss, environmental degradation, and poaching activities targeting the deer's meat, hide, and antlers. The Timor Deer population is estimated to have declined by approximately

10% of the total, and the species is currently listed on the IUCN Red List with a “Vulnerable” status, meaning it is at risk of extinction (Rumakar et al., 2019).

The Tasikoki Wildlife Rescue Center (PPST) is an ex-situ conservation facility established to care for, rehabilitate, and return wildlife victims of illegal trade to their natural habitats or appropriate breeding facilities. PPST is located in Bitung City, North Sulawesi, and serves as a key hub in the wildlife rescue network across the Wallacea region. The facility houses various endemic and protected species, including the Timor deer (*Cervus timorensis*), which is often a victim of poaching and illegal trade (Tasikoki, 2012).

As ruminants, Timor deer exhibit complex social interactions and are highly dependent on the stability of their group structure to maintain social and physiological stability. Imbalances in social structure can trigger stress and reproductive disorders that negatively impact physiological functions such as digestion and metabolism (Latifah, 2023).

The main issue that arises is the lack of ecological and social data on Timor deer populations outside their natural habitat, particularly in conservation facilities such as the PPST. Social structure in deer significantly influences reproductive success and the age at which they begin breeding. Mismatches in social structure and habitat disturbances pose a serious threat to the survival of the Timor deer (Rumakar et al., 2019). Therefore, research on the social structure and community dynamics of the Timor deer is urgently needed as a basis for developing sustainable population management policies and reintroduction programs.

Methods

Time and Place of Research

This study was conducted in October 2025 at the Tasikoki Wildlife Rescue Center in Bitung City, North Sulawesi. The study location is shown in **Figure 1**.

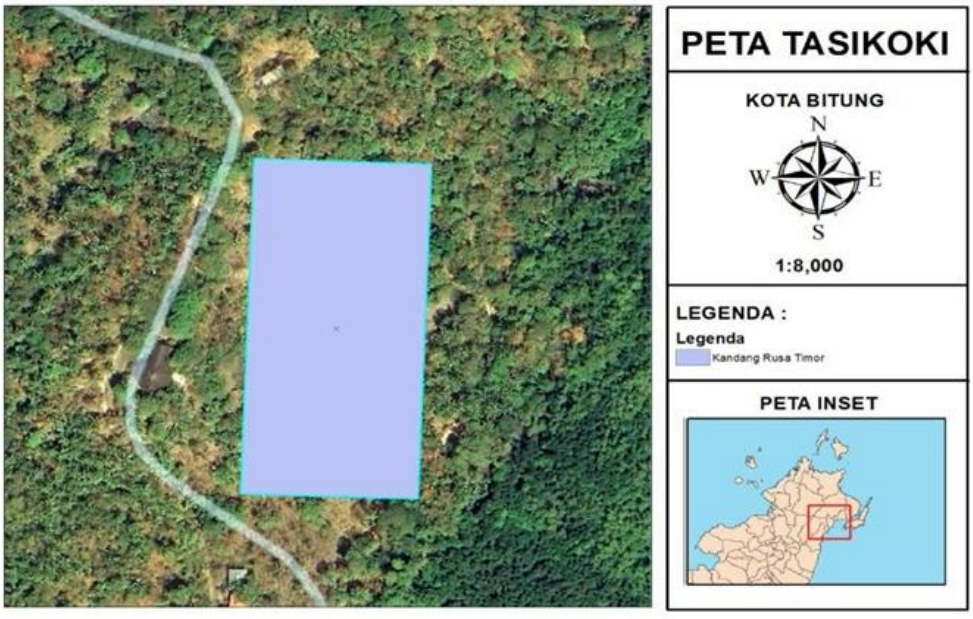

Figure 1. Research location

Tools and Materials

The tools and materials used in this study were: a camera, writing utensils, a telescope, and cctv.

Research procedures

The subject of this study is a group of Timor deer (*Cervus timorensis*), consisting of a dominant adult male (alpha), adult females, and juvenile deer. The primary focus of this observation is on the social interactions of Timor deer within their group structure. Techniques for collecting data on Timor deer feeding activities used was direct behavioral observation employing the focal animal sampling technique. The social interaction variables observed and recorded include agonistic or aggressive behaviors (chasing, butting, chasing away, threatening) and affiliative or friendly behaviors (grooming, following, playing).

The social interaction behavior of Timor deer was observed directly in the field and via CCTV monitoring over a 10 days observation period, 12 hours daily from 6:00 am to 6:00 pm WITA. Prior to the study, a habituation process was conducted until the Timor deer became accustomed to the presence of observers. Once adaptation was achieved, the observation of social interactions could proceed. This habituation phase is crucial to ensure that the deer's daily behavior is not disrupted by the researchers' presence (Sofyan and Setiawan, 2018).

Data Collection on Social Behavior

Data collection for this study was conducted through direct observation of the social interactions of Timor deer (*Cervus timorensis)* at the PPST social enclosure in Bitung City. The observations focused on a single group of deer consisting of several individuals with varying age and sex structures, including adult males, adult females, juveniles, and fawns. Before the observations began, each individual in the group was identified and distinguished based on morphological characteristics such as body size, the shape and number of antler points, and coat color. This identification was essential to ensure the accuracy of behavioral records for each individual throughout the study.

Data analysis

The data collected from observations were analyzed using quantitative descriptive methods to describe the community structure and social dynamics of the Timor deer population at PPST. The frequency of each behavioral category was calculated and expressed as a percentage, which was then presented in tables and graphs showing the distribution of daily behaviors.

The method used in this study was the Focal Sampling method. The percentage of activity for each individual was calculated using the formula (Martin and Batcson, 1988, as cited in Putra, 2016):

Percentage of activity frequency = $\frac{A}{B} \times 100\%$

Description:
A = Frequency of activity each day
B = Total frequency of all activities each day

Results and Discussions

Results Analysis of the Structure and Composition of the Timor Deer

Based on observations conducted over a 10-days period, the number of individuals in a single social group of Timor deer (*Cervus timorensis*) successfully observed at the PPST was 21. The age structure of the group consisted of 6 adults, 9 subadults, and 6 juveniles. Age categories were determined based on visually observable morphological characteristics, namely body size, antler development in males, and coat color. According to Maha et al. (2021), non-invasive identification

of Timor deer can be performed accurately based on a combination of these morphological characteristics.

The sex composition of the group consisted of 7 males and 8 females (6 juveniles whose sex had not yet been determined). When juveniles were excluded from the calculation, the male-to-female ratio was 7:8, or approximately 1:1.14. This ratio indicates a slight female dominance within the group, which is a common pattern in captive Timor deer populations. Purba et al. (2023) state that in captive Timor deer populations, a male-to-female ratio approaching 1:1 to 1:2 results in optimal reproductive success. Complete data on community structure are presented in **Table 1**.

Table 1. Community structure of Timor Deer Group at PPST

ID	Sex	Age class	Dominance Status	Morphological Characteristics
A	Male	*Adult*	Alpha	Upright posture, fully developed antlers (3 branches)
B	Male	*Adult*	Subordinate	Relatively large body size
C	Male	*Sub adult*	Subordinate	Two-branched antlers
D	Male	*Adult*	Subordinate	Medium body size, dark brown fur
E	Male	*Sub adult*	Subordinate	New antler growth, light brown fur
F	Male	*Sub adult*	Subordinate	New antler growth, medium body size
G	Male	*Sub adult*	Subordinate	New antler growth, dark brown fur
H	Female	*Adult*	Group member	Relatively large body size
I	Female	*Adult*	Group member	Relatively large, dark brown fur
J	Female	*Adult*	Group member	Relatively large, light brown fur
K	Female	*Sub adult*	Group member	Medium size, smaller than H
L	Female	*Sub adult*	Group member	Medium size, dark brown fur
M	Female	*Sub adult*	Group member	Medium size, light brown fur
N	Female	*Sub adult*	Group member	Relatively small among females
O	Female	*Sub adult*	Group member	Medium size, darker head pattern
P	Juvenile	*Juvenile*	Group member	Largest among juveniles
Q	Juvenile	*Juvenile*	Group member	Medium size, light brown fur
R	Juvenile	*Juvenile*	Group member	Light pattern around neck
S	Juvenile	*Juvenile*	Group member	Medium size, darker fur
T	Juvenile	*Juvenile*	Group member	Smaller than S
U	Juvenile	*Juvenile*	Group member	Smallest in group

Based on the observations, a single dominant male acting as the alpha (Individual A) was observed within the group. This individual can be identified by several distinctive characteristics: the longest antlers with a perfect three-pronged structure, consistently initiating aggressive behavior such as chasing and driving away other individuals, and gaining priority access to food sources. Pratama (2022) states that the alpha male in a Timor deer group plays a role in stabilizing social dynamics and has priority access to females, food, and territory. A sex ratio approaching 1:1.14 reflects a relatively ideal composition for supporting reproductive stability (Fauziah, 2023).

Daily Social Interactions of Timor Deer Community at PPST

Based on observations of the Timor deer community at PPST over a 10-days period, a total of 52 instances of social interaction were recorded. Agonistic behavior was recorded in 27 instances (51.9%) and affiliative behavior in 25 instances (48.1%), as shown in **Table 2**. The data indicate that competitive social interactions were slightly more dominant than cooperative interactions, although the difference was not particularly large.

Table 2. Frequency of Social Interactions in Timor Deer Community

Type of Interaction	Frequency	Percentage (%)
Agonistic	27	51.9%
Affiliative	25	48.1%
Total	52	100%

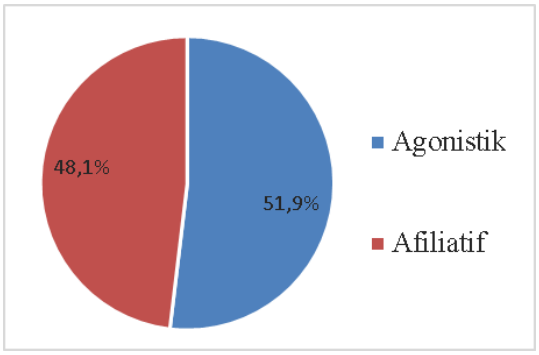

Figure 2. Circular Diagram of the Social Interactions of the Timor Deer

Agonistic Behavior

Agonistic interactions are behaviors related to aggression, competition, and dominance among individuals. In this study, agonistic interactions were the most dominant type of interaction, with a total of 27 incidents (51.9%), including fighting (5 incidents), threatening (1 incident), chasing (2 incidents), chasing away (18 incidents), and butting (1 incident) (**Table 3**). Agonistic interactions most often involved alpha individuals (A) as the initiators, particularly in confrontations with sub-adult males.

Tabel 3. Frequency of Agonistic Social Interactions In Timor Deer Community

Type of Interaction	Frequency	Percentage (%)
Fighting (Berkelahi)	5	18.52%
Threat display (Menggertak)	1	3.70%
Chasing (Mengejar)	2	7.41%
Displacement (Mengusir)	18	66.67%
Butting (Menanduk)	1	3.70%
Total	27	100%

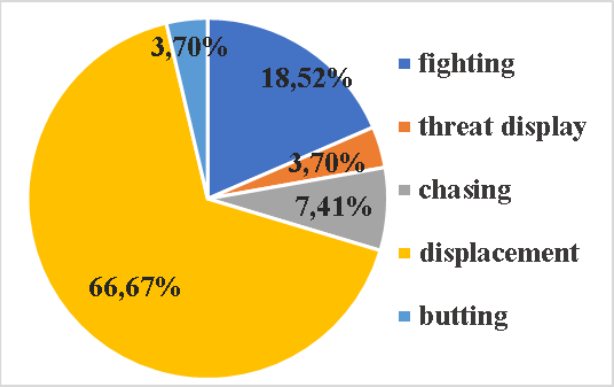

Figure 3. Circular diagram of agonistic behavior

Chasing behavior was the most dominant and was performed not only by alpha males but also by females and juveniles, consistent with the findings of Sofyan and Setiawan (2018) that food competition is the primary trigger for agonistic behavior, the intensity of which positively correlates with individual density within the enclosure. Chasing behavior is reactive and spontaneous when feeding activity increases, while threatening is carried out through visual signals and body posture without physical contact as an efficient mechanism to assert dominance while minimizing the risk of injury (Madja et al., 2018). Fighting behavior is brief and non-injurious and is commonly observed among females and juveniles, whereas head-butting is exclusively performed by males as the most explicit form of dominance assertion, whether in the competition for females or food (Gusmalinda et al., 2018; Silalahi et al., 2021). Overall, the high frequency of these agonistic interactions indicates the need for attention to feed distribution management to minimize potential stress resulting from excessive competition within the group (Xavier et al., 2018).

Affiliative behavior

Affiliative interactions are social behaviors that reflect closeness and positive bonds among individuals within a group. In this study, 25 instances (48.1%) of affiliative interactions were observed, encompassing three types of behavior: grooming (15 instances), following (3 instances), and mounting (7 instances) (**Table 4**). Affiliative behavior occurred most frequently between adult females and juveniles, as well as among females within the same group.

Tabel 4. Frequency of Affiliative Social Interactions In Timor Deer Community

Type of Interaction	Frequency	Percentage (%)
Grooming (Membersihkan bulu)	15	60%
Mounting (Percobaan kopulasi)	7	28%
Following (Mengikuti)	3	12%
Total	25	100%

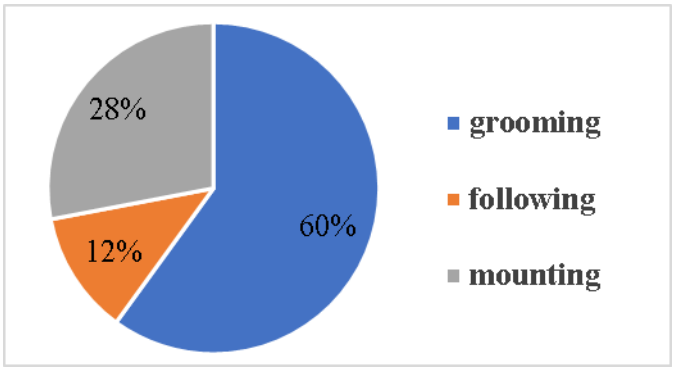

Figure 4. Circular diagram of affiliative behavior

Based on the data, grooming behavior is the most dominant and is generally performed by adult females on juveniles as well as among females, using their teeth and tongues to clean the head, neck, and back. This behavior not only serves to maintain physical cleanliness by removing dirt and ectoparasites but also strengthens social bonds, reduces stress, and builds trust within the group (Latifah, 2023). The grooming patterns that occur more frequently between females and juveniles reflect the collective caregiving patterns common in social, group-living mammals (Sofyan and Setiawan, 2018). The observed following behavior, recorded in 3 instances, serves as an indicator of strong social bonding and reflects interindividual social preferences, closely tied to the formation of parent-offspring bonds and informal hierarchies within the female group (Gusmalinda et al., 2018). Meanwhile, all copulation attempts were made by subadult males toward females without aggression, indicating active reproductive activity related to the female estrus cycle, although mating access remains prioritized for alpha males as the dominant sires, while subordinate males are generally deterred by the alpha's agonistic behavior when attempting to approach females (Pratama, 2022).

Conclusion

The Timor deer community structure at PPST consists of 21 individuals divided into three age categories: 6 adults, 9 subadults, and 6 juveniles, with a male-to-female ratio of 1:1.14, and one dominant male identified as the alpha leading the group and having priority access to food and females, reflecting the natural pattern of Cervus timorensis with its characteristic linear dominance system. Daily social interactions within the community were dominated by agonistic behavior, totaling 27 incidents (51.9%) including fighting, chasing, chasing away, threatening, and butting primarily triggered by competition for food access, as well as affiliative behavior, totaling 25 incidents (48.1%) including grooming, following, and copulation attempts, with affiliative behaviors occurring more frequently between adult females and juveniles, reflecting the group's collective parenting patterns.

References

Amiati, A. D., Masyud, B., & Garsetiasih, R. (2015). Pengaruh pengunjung terhadap perilaku dan pola konsumsi rusa Timor (*Rusa timorensis* de Blainville 1822) di penangkaran hutan penelitian Dramaga. *Jurnal Plasma Nutfah*, 21(2), 47-60.

Blainville, H.M.D. de. (1822). *Description. Journal de Physique, de Chimie, d'Histoire Naturelle et des Arts*, 94: 267.

Bunga, R., Kawatu, M. M., Wungow, R. S. H., & Rompas, J. J. (2018). Aktivitas harian rusa Timor (*Cervus timorensis*) di taman marga satwa Tandurusa Aertembaga, Bitung- Sulawesi Utara. *Zootec*, 38(2), 345-356.

Fauziah, I. (2023). Perilaku harian rusa Timor (*Cervus timorensis*) jantan dan betina di penangkaran Kabupaten Magelang (Skripsi). Universitas Islam Negeri Sunan Kalijaga.

Gusmalinda, R., Dewi, B. S., Masruri, N. W. (2018). Perilaku Sosial Rusa sambar (*Cervus unicolor*) dan Rusa Totol (Axis axis) di Kandang Penangkaran PT. Gunung Madu Plantations Lampung Tengah. *Jurnal Sylva Lestari*. 6(1):74-84.

Hofmann, R. R. (2020). *Ecology of browsing and grazing animals: Digestive strategies and adaptations*. Springer Nature.

ITIS. (2024). Integrated Taxonomic Information System. Available at: https://itis.gov (accessed September 2025).

IUCN. (2015). *Cervus timorensis*: The IUCN Red List of Threatened Species 2015.

Latifah, L. (2023). *Perilaku sosial Rusa Timor (Cervus timorensis De Blainville, 1822) dewasa dan anakan di penangkaran Tahura Bunder Yogyakarta* (Skripsi, Program Studi Biologi, Fakultas Sains dan Teknologi, UIN Sunan Kalijaga, Yogyakarta).

Madja,T. J., Johan, F. Koibur., Pattiselanno, F.2018. Tingkah Laku Sosial Rusa Timor (*Cervus timorensis*) Di Penangkaran Bumi Marina, Manokwari. *Jurnal Ilmu Peternakan dan Veteriner Tropis*, 8(02): 51-55.

Maha, I. T., Manafe, R. Y., Amalo, F. A., & Selan, Y. N. (2021). Karakteristik morfologi rusa Timor (*Rusa timorensis*) dengan pemeliharaan ex situ di Kota Kupang. *Acta Veterinaria Indonesiana*, 9(1), 1-13.

Pratama, R. A. (2022). Tingkah laku sosial rusa Timor (*Cervus timorensis*) di penangkaran Karang Kemiri (Skripsi). Universitas Gadjah Mada.

Purba, R. D., Dewi, B. S., & Harianto, S. P. (2023). Perilaku seksual rusa Timor (*Cervus timorensis*) di penangkaran rusa Universitas Lampung. *Journal of People, Forest and Environment (JOFPE)*, 3(1), 54–63.

Romansah, A. Y., Tana, S., & Kasiyati. (2024). Perilaku makan rusa Timor (*Rusa timorensis*) betina di area penangkaran ex-situ Dawe Kudus, Jawa Tenga. Program Studi Biologi, Fakultas Sains dan Matematika, Universitas Diponegoro.

Rumakar, S., Puttileihalat, M. M. S., & Tuhumury, A. (2019). Populasi dan Habitat Rusa Timor (*Cervus timorensis*). *Makila*, 13(1), 40-56.

Semiadi, G. (2018). Biologi dan perilaku rusa Timor (*Cervus timorensis*) dalam penangkaran. *Jurnal Ilmu-Ilmu Peternakan*, 28(1), 10-20.

Semiadi, G., Nugraha, R. T. P. (2004). *Panduan pemeliharaan rusa tropis*. Buku, 282 hal. Pusat Penelitian Biologi, Lembaga Ilmu Pengetahuan Indonesia.

Silalahi, S. S., Samsudewa, D., Setiatin, E. T., Ondho, Y. S. 2021. Tingkah Laku Agresif Rusa Timor (*Cervus timorensis*) Jantan di Penangkaran Pada Fase Diurnal dan Nocturnal. *Livest. Anim. Res*,19(1): 40-47.

Sofyan, I., & Setiawan, A. (2018). Studi perilaku harian rusa Timor (*Cervus timorensis*) di penangkaran rusa Tahura Wan Abdul Rachman. *Jurnal Ilmiah Biologi Eksperimen dan Keanekaragaman Hayati (J-BEKH)*, 5(1), 67-76.

Tasikoki (2012) Profil Pusat Penyelamatan Satwa Tasikoki. Tasikoki Education Blog. Available at https://tasikokiedu.wordpress.com/profil/ [Diakses 8 September 2025].

Van Wieren, S. E., & Hofmann, R. R. (2016). *Ecology and behaviour of deer: Adaptations for survival*. London: Chapman & Hall.

Xavier, S., Harianto, S. P., dan Dewi, B. S. (2018). Pengembangan Penangkaran Rusa Timor (*Cervus timorensis*) di Taman Hutan Raya Wan Abdul Rachman Lampung. *Jurnal Sylva Lestari*, 6(2):94–102.