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Assessment of Spotted Deer Welfare Utilizing the Five Freedoms of Animal Welfare Approach

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Abstract

The practice of wild animal captivity serves to augment their populations and preserve their genetic integrity. The spotted deer (*Axis axis*) captive area at Hasanuddin University's Faculty of Animal Science not only serves these conservation objectives but also provides an interactive experience for visitors. The welfare of these captive deer is influenced by feed management strategies, the adequacy of facilities, and the impact of visitor interactions. This study employs a semi-quantitative approach to assess the welfare practices for spotted deer at the university's breeding center. The assessment is structured around the questionnaire provided in the Regulation of the Director General of Forest Protection and Nature Conservation No. P.6/IV-SET/2011 concerning Guidelines for Assessment of Conservation Institutions, which utilizes the five freedoms of animal welfare as its assessment framework. Observations and interviews reveal that the welfare provision for the spotted deer is rated at 66.8%, qualifying it as adequate. The assessment highlights areas where improvements can be made to enhance the overall well-being of the deer, such as customized feeding and handling of pregnant and lactating deer as well as visitor interaction management.

Keywords: Animal welfare assessment, Axis axis, captivity, Hasanuddin University

Introduction

The spotted deer (*Axis axis*), native to the Indian subcontinent (Randel & Tomeček, 2021), were translocated from Bogor to Hasanuddin University in Makassar in 2011. Initially, the deer resided at the university's main gate park before being moved to the Faculty of Animal Science in 2017, where they have since thrived. The primary objective of this captive breeding program is to increase the population of the species and preserve their genetic diversity (Suharto et al., 2019). The deer enclosure at the Faculty of Animal Science has become a popular attraction for visitors, fulfilling both educational and recreational roles. This public engagement, while beneficial for awareness, has led to an increase in visitor numbers and direct contact with the deer (Basrul, 2015). The welfare of animals in such environments is of paramount importance; it is crucial that the enclosures serve as sanctuaries, protecting the deer from potential hazards (Guntoro, 2023).

Previous research by Suharto et al. (2019) highlighted concerns regarding competitive behaviors among the deer during feeding times, a situation that has been intensified by visitor interactions. Such dynamics are intricately linked to the broader discourse on animal welfare within captivity. Despite the significance of these issues, there is a lack of comprehensive research on the health and welfare of the deer at Hasanuddin University's breeding center. Effective management practices are vital to prevent negative outcomes such as illness, stress, or mortality among the deer. This gap in knowledge and the urgent need for well-informed management approaches have led to this study, which seeks to assess the welfare practices at Hasanuddin University's deer breeding center, utilizing the five freedoms of animal welfare as a guiding framework.

Meterials and Methods

This study was conducted in December 2023 and January 2024 at the Spotted Deer Breeding Center, which is part of the Faculty of Animal Science at Hasanuddin University, located in Makassar City, South Sulawesi Province, Indonesia. The welfare assessment of the spotted deer was based on the criteria outlined by the Indonesian Ministry of Forestry (2011a) in the Regulation of the Director General of Forest Protection and Nature Conservation No. P.6/IV-SET/2011, which provides guidelines for evaluating conservation institutions. The assessment framework included five aspects of animal welfare, each consisting of multiple sub-aspects. These sub-aspects were evaluated using a series of questions designed to measure the extent to which each welfare element was addressed (Table 1). Responses to these questions were scored on a scale from 1 to 5, with each score representing a specific level of welfare quality, ranging from 'Bad' to 'Satisfying' (Table 2).

Table 1. Components of deer welfare assessment.

Aspect of welfare	Sub-aspects assessed
Freedom from hunger and thirst	1. Quantity and quality of feed and drinking water 2. Variety of feed types 3. Control of feed distribution 4. Feed storage 5. Feeding station 6. Cleanliness of feed and water containers 7. Customized feeding for pregnant and lactating deer 8. Provision of feeding by visitors
Freedom from environmental discomfort	1. Similarity of enclosure to natural habitat 2. Protection from adverse weather conditions 3. Availability of a shady, safe, and comfortable place 4. Conditions of trees in captivity
Freedom from pain, injury, and disease	1. Frequency of health examinations 2. Availability of healthcare facilities 3. Animal vaccination program 4. Health care from a veterinarian
Freedom from fear and distress	1. Handling of pregnant and lactating deer 2. Restrictions on personnel handling deer 3. Warning signs for visitors
Freedom to express normal behavior	1. Visitor behavior 2. Security measures on enclosure 3. Enrichment of enclosure

Table 2. Scoring values for each question.

Score	Label	Description
1	Bad	The management is absent
2	Not enough	The management is present but not adequate
3	Enough	The management is present and adequate, but not implemented
4	Good	The management is present, adequate, and partially implemented
5	Satisfying	The management is present, adequate, and fully implemented

Data collection involved direct observations and structured interviews with personnel engaged in the care of the deer. Observations were conducted twice daily, from 8 to 11 AM and 3 to 5 PM, over a period of 30 days. The average scores from the responses to the questions within each sub-aspect were calculated to determine the overall score for that sub-aspect. Similarly, the average of these sub-aspect scores provided the score for each main aspect of welfare.

Following the scoring process, the scores were weighted according to the significance of each welfare component (Table 3), as determined by Mubarak et al. (2021). This weighting was not prescribed by statutory regulation but was instead adopted from the referenced study. The average of weighted scores was taken to ascertain the final welfare score for the spotted deer.

Table 3. Weighted value of animal welfare aspects.

Aspect	Score range	Weight	Weighted value range
Freedom from hunger and thirst	1–5	30%	30–150
Freedom from environmental discomfort	1–5	20%	20–100
Freedom from pain, injury, and disease	1–5	20%	20–100
Freedom from fear and distress	1–5	15%	15–75
Freedom to express normal behavior	1–5	15%	15–75

The quantitative scores were further categorized into one of four semi-quantitative classifications to facilitate a clear interpretation of the welfare status. These classifications ranged from 'Very good' to 'Need improvements', providing a succinct summary of the welfare conditions (Table 4). The findings from this assessment were intended to serve as evaluative feedback and recommendations for the management of the spotted deer breeding program.

Table 4. Classification of animal welfare assessments.

Quantitative score	Assessment classification
80.00–100	Very good
70.00–79.99	Good
60.00–69.99	Adequate
< 60.00	Need improvements

Results and Discussion

The spotted deer captive area spans approximately 5,261.4 m². The main enclosure contains two smaller enclosures and a shelter. The deer are reared semi-intensively, with food provided by both the management and visitors to the breeding facility. At the time

of this study, the deer population consisted of 34 individuals, comprising 8 adult males, 19 adult females, and 7 fawns.

The welfare assessment of the spotted deer is based on five fundamental aspects: freedom from hunger and thirst, freedom from environmental discomfort, freedom from pain, disease, and injury, freedom from fear and suffering, and freedom to express natural behavior. These aspects were assessed using a questionnaire derived from the Regulation of the Director General of Forest Protection and Nature Conservation Number P.6/IV-SET/2011 concerning Guidelines for Assessment of Conservation Institutions.

Freedom from Hunger and Thirst

Adequate food and water are crucial for the survival of deer. The quality and quantity of feed and water are vital components that must be managed effectively to ensure this freedom. The assessment of this aspect is divided into eight sub-aspects, which were evaluated through 16 questions. The assessment results for this aspect are detailed in Table 5 below.

Table 5. Assessment of the aspect of freedom from hunger and thirst.

Sub-aspect	Score	Description
Quantity and quality of feed and drinking water	4	Feed menu is available; feed and water quality are sufficient but quantity is not guaranteed at all times
Variety of feed types	4	Manager provides complete commercial feed formulations; visitors provide varied plants as feed
Control of feed distribution	4	Animal caretaker monitors feed provided; aware of uneaten feed but does not report to feed nutrition section
Feed storage	1	Feed is placed within the enclosure area; no dedicated feed warehouse or storage location
Feeding stations	4	Feeding stations are more than one per enclosure; movable but no stations outside enclosure
Cleanliness of feed and water containers	4	Feeding and drinking areas are maintained for sanitation; some soil or fecal contamination visible
Customized feeding for pregnant and lactating deer	1.5	Feed nutrition section exists but no customized feed menu for pregnant and lactating deer
Provision of feeding by visitors	1	No supervision to visitors
Total score	23.5	
Average score	2.93	

The primary sources of food for the deer include the breeding center managers, visitors, and surrounding plants. Animal caretakers typically provide food and water once daily in the morning or evening without consistent feeding times. During the dry season, caretakers visit twice daily to ensure drinking water availability. Kissinger et al. (2021) recommend feeding 2–3 times daily with a mix of forage and concentrate feed, emphasizing the importance of constant access to clean drinking water.

Observations revealed that caretakers provide daily food consisting of two bags of concentrate (50 kg each) and water in an 80-liter container. Visitors contribute additional food such as carrots, water spinach, mustard greens, or plants from the breeding center's vicinity. Suharto et al. (2019) reported that visitor-provided forage ranged from 0.022 kg/head to 0.330 kg/head. Hombing et al. (2016), citing Perum Perhutani (1997), estimate that breeding centers require 1 kg/head/day for concentrate feed and 6–10 kg/head/day for forage. This suggests that while the concentrate provided by caretakers meets dietary needs, visitor-provided forage falls short.

The physical condition of both adult deer and fawns was generally moderate during observations; no deer were found to be underweight or overweight. Garsetiasih and Herlina (2005), referencing Lavieren (1983), classify spotted deer physical conditions as fat (coccyx and pelvis bones are not visible), moderate (pelvic bones are visible), or thin (spine and rib bones are prominent). Physical condition assessments were conducted when deer were standing or eating. Their physical condition can be seen in Figure 1.

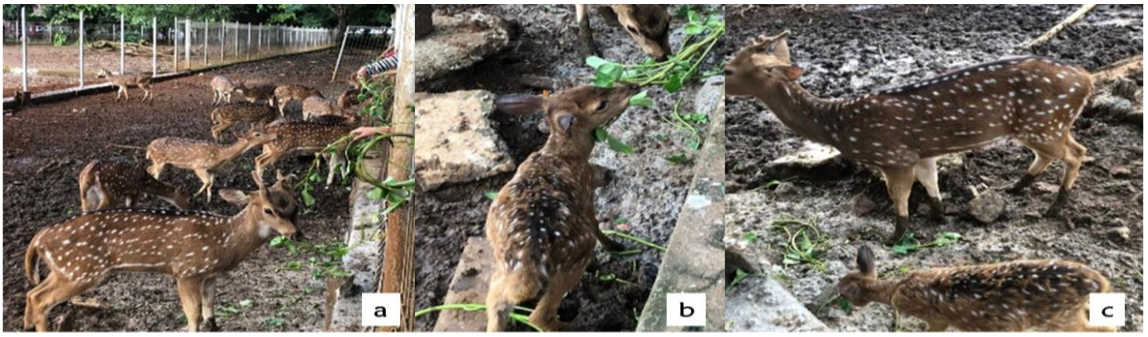

Figure 1. Deer body condition: (a) males, (b) fawns, (c) females.

Commercial food supplies are stored outside enclosures, risking contamination by soil and exposure to rainwater. Feed containers within enclosures are not regularly cleaned, showing signs of soil or fecal contamination. The condition of feed containers, water containers, and storage locations can be observed in Figure 2 below.

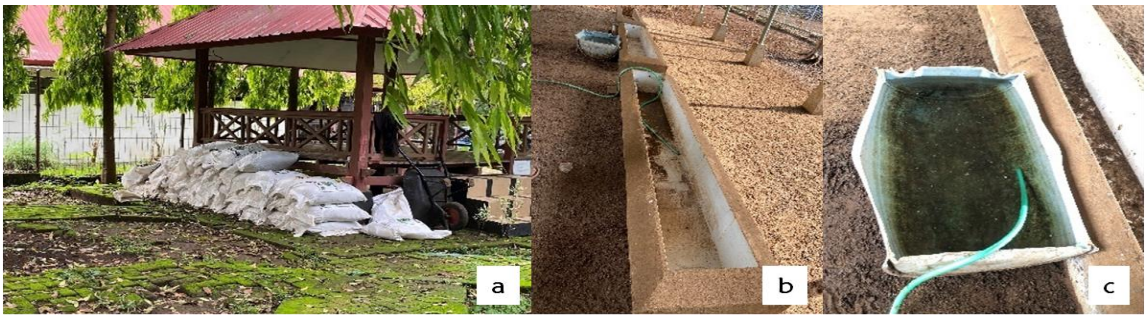

Figure 2. Condition of (a) feed storage location, (b) feed container, (c) water container.

The Indonesian Ministry of Forestry (2011b) mandated that animals kept in captivity must be provided with food and water by paying attention to the type, quantity and frequency of feeding and drinking, the food menu and the way the food is served. In addition, feed and water should be prevented from contamination and pest infestation. However, the breeding enclosure lacks such facilities, potentially leading to contaminated feed. Nurhayati et al. (2020) state that animal containers should be accessible within enclosures. In this center, containers meet accessibility standards but lack regular cleaning. Hombing (2016)

emphasizes the importance of quality feed for pregnant deer to maintain maternal body condition. Fawns should receive young forage cut into small pieces from two weeks old onwards. This sanctuary does not provide a specialized feed menu for pregnant and lactating deer, nor are there regulations controlling the feeding by visitors.

Freedom from Environmental Discomfort

This aspect is divided into four sub-aspects, which were assessed through 10 questions. The assessment of environmental discomfort includes factors such as temperature, humidity, lighting, and shelter management, which are essential for the well-being of spotted deer in captivity. Temperature and relative humidity were measured five times, once each week, to obtain an average that reflects the conditions within the breeding center. These measurements are presented in Table 6 below.

Table 6. Measurement of temperature and relative humidity in the breeding center.

Parameters	Morning	Afternoon	Evening
Temperature (°C)	27.9	30.98	26.52
Relative humidity (%)	77	74	85

Spotted deer, indigenous to forested areas, open plains, and regions near rivers, can adapt to a broad spectrum of temperatures and altitudes. Hidayadi (2023), citing Zulwan (2004), notes that these deer can inhabit environments with temperatures ranging from 17.78 °C to 40.56 °C. At the breeding center, temperature readings are within this adaptive range, with morning temperatures (measured between 8 and 10 AM) averaging 27.98 °C, afternoon temperatures (measured between 12 PM and 2 PM) at 30.98 °C, and evening temperatures (measured between 7 and 8 PM) at 26.52 °C. Although Saputra et al. (2021) indicate that temperature, humidity, and lighting do not significantly affect the success of captivity due to the deer's adaptability, Semiadi and Nugraha (2004) acknowledge that optimal environmental conditions are conducive to plant growth, which is vital for forage. They suggest that temperatures between 25 °C and 45 °C are ideal. The results of the assessment for freedom from environmental discomfort are detailed in Table 7 below.

Table 7. Assessment of the aspect of freedom from environmental discomfort.

Sub-aspect	Score	Description
Similarity to natural habitat	4	Temperature, ventilation, and lighting are appropriate
Protection from adverse weather	3	Shelters are present but not sufficient for all deer
Availability of a shady, safe, and comfortable place	4	Enclosure conditions are good; however, fecal contamination was observed
Conditions of trees in captivity	5	Trees are safe and monitored; provide shade and comfort
Total score	16	
Average score	4	

The spotted deer captive area is an open space, ensuring that the deer receive optimal ventilation and sunlight every day. There is adequate lighting at night outside the enclosure

to monitor the safety of the deer. Generally, management related to ventilation and lighting in deer breeding aligns with the National Animal Welfare Committee (2018), which recommends sufficient ventilation to prevent excessive heat and continuous lighting to ensure the safety of deer. The deer shelter stands at 2.8 meters high, adhering to Semiadi and Nugraha's (2004) statement that shelters should have a roof ceiling height of at least 2 meters to avoid inconvenience to the deer. The condition of the shelter can be observed in Figure 3 below.

Figure 3. Shelter for deers.

The natural vegetation in captivity comprises seven trees that serve as resting places for the deer. However, two of these trees are in poor condition due to male deer frequently rubbing their antlers against them, causing the tree bark to peel off and leaves to fall easily. There are four trees located in the middle of the enclosure near the deer shelter, two at the left end of the enclosure, and one at the right end. The tree vegetation is in accordance with the statement by Semiadi and Nughraha (2004) that during the antler shedding period, deer feel itchy and rub their antlers on hard surfaces such as trees or the ground.

Freedom from Pain, Injury, and Disease

The assessment of this aspect is divided into four sub-aspects, which were evaluated through 18 questions. At the deer breeding center, animal caretakers conduct daily health checks. If a deer is ill or requires attention, the issue is reported to the manager for veterinary follow-up. The results of this assessment are summarized in Table 8.

Table 8. Assessment of the aspect of freedom from pain, injury, and disease.

Sub-aspect	Score	Description
Frequency of health examinations	5	All deer are healthy and active; conditions are checked daily by caretakers.
Availability of healthcare facilities	3.3	No designated treatment space or pest control; however, medical and predator control facilities are available.
Animal vaccination program	1	No vaccination program is in place for the deer.
Health care from a veterinarian	4.1	Biosecurity protocols for staff, medical records, and controlled medication use are managed by the veterinarian.
Total score	13.4	
Average score	3.35	

The breeding center lacks dedicated health room facilities, limiting the capacity for

comprehensive deer healthcare. All medical equipment is supplied by the veterinarian responsible for treatment. Although the deer have not been vaccinated, they have undergone parasite examinations. The absence of vaccinations is a decision made by the veterinarians and managers, with disease prevention focusing on biosecurity measures, such as the use of personal protective equipment by caretakers and periodic disinfection of the enclosure. Previous parasite examinations revealed no infections, leading to the discontinuation of these checks. According to the Regulation of the Director General of Forest Protection and Nature Conservation, routine health assessments, including parasite checks and vaccinations, should be conducted at intervals recommended by veterinarians.

Observations indicate that the deer in captivity are generally healthy and active, with the exception of one young deer who sustained a leg deformity after being stepped on by an adult deer. Despite the limp, this deer has received appropriate veterinary care. Semiadi and Nugraha (2004) note that deer have a relatively high resistance to diseases compared to other livestock. A decline in health without apparent disease could be attributed to prolonged stress from environmental factors. Supportive treatments, including environmental improvements and vitamin therapy, are recommended in such cases.

In 2023, several deer fatalities were recorded: one male deer died following a fight, three fawns died due to trampling, and a female deer died from complications during childbirth. To mitigate such incidents, the manager relocated some deer to prevent dominance and aggression. Samsudewa and Capitan (2011) advocate for segregating enclosures based on age and physiological status to enhance reproductive and health management. The protocol for deceased deer involves documentation and reporting to the manager, followed by burial near the breeding facility, aligning with Kissinger et al. (2021), who emphasize the importance of maintaining records for ongoing animal welfare monitoring. The goal of being free from pain, disease, and injury is paramount in managing deer health and preventing suffering. The current welfare practices are commendable, yet there is a clear need for improved health facilities within the captivity setting to better support deer inspections and treatments.

Freedom from Fear and Distress

The assessment of freedom from fear and stress is divided into three sub-aspects and assessed through eight questions. It considers the handling of pregnant or lactating deer and the regulation of visitor interactions. The findings are summarized in Table 9.

Table 9. Assessment of the aspect of freedom from fear and distress.

Sub-aspect	Score	Description
Handling of pregnant and lactating deer	1	No separate accommodations for pregnant and lactating deer.
Restrictions on personnel handling deer	4.6	Deer handling is restricted to caretakers or authorized individuals.
Warning signs for visitors	3	No warning signs; physical contact limited by wire fences
Total score	8.6	
Average score	2.86	

Observations and interviews reveal that caretakers do not consistently separate pregnant and lactating deer due to accessibility challenges. Separation is only feasible when the deer are approachable, despite the absence of dedicated spaces for this purpose. Semiadi and Nugraha (2004) emphasize the importance of separation before and after birth to ensure the mother's tranquility and the fawn's acclimatization. Spotted deer exhibit more restless behavior and are more prone to disturbance than other tropical deer species, leading to restricted access to the breeding enclosure. Guntoro (2023) highlights that animal welfare concerns often stem from high levels of human–animal interaction. In public displays, animals frequently engage closely with visitors. Although there are no warning signs for visitors, physical contact is constrained by wire fences. Visitor feeding induces competition among deer, risking physical harm to both deer and visitors. Figure 4 will illustrate these interactions.

Figure 4. Interactions between visitors and deers.

Spotted deer are notably more temperamental and prone to panic than other tropical deer, as noted by Semiadi and Nugraha (2004). A minimum fence height of 1.8 meters is recommended for their enclosures. The current fence height of 2.2 meters is adequate, yet the lack of clear warnings about contact limitations and appropriate visitor feeding practices can lead to food competition and potential injuries among the deer.

Freedom to Express Normal Behavior

The assessment of the aspect of freedom to express normal behavior is categorized into three sub-aspects, evaluated through 10 questions. This aspect encompasses the influence of visitor presence and behavior, security measures of the enclosure, and enrichment of the enclosure. The findings are detailed in Table 10.

Table 10. Assessment of the aspect of freedom to express normal behavior.

Sub-aspect	Score	Description
Influence of visitor presence	3	Visitor presence impacts feeding behavior.
Security measures on enclosure	3.75	Security is somewhat lacking, with risks of dominance and conflict, but boundaries prevent direct contact.
Enrichment of enclosure	4	Trees promote natural behavior, but no separate space for pregnant deer.
Total score	10.75	
Average score	3.58	

Observations suggest that the enclosure size is insufficient to prevent overcrowding, individual dominance, and ongoing conflict. While there is no established standard for enclosure size in deer breeding, Semiadi and Nugraha (2004) recommend a deer population density of 12–15 individuals per hectare. The breeding center houses 34 deer in an area of approximately 5,261.4 m² or 0.52 hectares, indicating that the facility is operating beyond its optimal capacity. This overcrowding often leads to adult male deer asserting dominance, resulting in persistent conflict. Visitor feeding exacerbates this issue by creating competition among deer for food. However, the presence of visitors does not seem to threaten or disturb the deer significantly. Signs of a deer feeling threatened typically include focused attention towards the disturbance, raised body hair, screeching, and fleeing from the threat.

Observations confirm that the security system of the deer enclosure is robust and under constant supervision by animal caretakers. The main access door to the enclosure is in good condition, while two additional doors are in disrepair and cannot be secured. Each door is situated at the ends of the enclosure, measuring 2.1 meters in width. This arrangement aligns with Semiadi and Nugraha's (2004) recommendation that doors be placed at the corners of the fence to facilitate the movement of deer, and is consistent with the standard door width of 2–2.5 meters for New Zealand paddocks.

The deer breeding center operates as an open demonstration enclosure, ensuring ample air circulation and direct sunlight. Elements that promote the deer's natural behavior include the presence of trees within the enclosure. Wirdateti et al. (2005) notes that male deer naturally rub their antlers as a display to attract females and as part of the antler shedding process. Similarly, Semiadi and Nugraha (2004) observe that female deer instinctively hide their newborns for the first 3–5 days post-birth. However, the current enclosure lacks a designated area for female deer to isolate themselves and their young, which is an aspect that could be improved to better accommodate their natural behaviors.

Final Score of Deer Welfare

After calculating the average value of the five aspects of animal welfare, the next step is to consolidate these values according to the weight of each component as determined by Mubarak et al. (2021). The weighted values reflect the relative importance given to each aspect, ensuring a balanced and comprehensive assessment of overall well-being. The final value, representing the cumulative welfare score, is obtained from this weighted approach and is shown in Table 11 below.

Table 11. Calculation of final welfare score.

Aspect	Score	Weight (%)	Weighted score
Freedom from hunger and thirst	2.93	30	87.9
Freedom from environmental discomfort	4.00	20	80.0
Freedom from pain, injury, and disease	3.35	20	67.0
Freedom from fear and distress	2.86	15	42.9
Freedom to express normal behavior	3.58	15	53.7
Average			66.3

The calculated final value is 66.3, which, when compared against the qualitative scoring criteria, categorizes the welfare status of the deer as adequate, which falls within the range of 60.00–69.99. This indicates that while the basic welfare needs of the deer are being met, there is room for improvement to elevate their welfare status to higher qualitative categories. By addressing the identified gaps, particularly in the aspects with lower scores, the welfare of the deer can be significantly improved, contributing to their overall health, well-being, and quality of life within the deer breeding center.

Conclusion

The comprehensive welfare assessment of the spotted deer at Hasanuddin University's breeding center, utilizing the five freedoms framework, has yielded a final welfare score of 66.3. This score indicates that the basic welfare needs of the deer are being met to an adequate level. However, the research has identified specific areas for improvement, such as structured feeding protocols, enhancing enclosure security, better management of visitor interactions, and providing specialized care for vulnerable groups like pregnant and lactating deer. These recommendations not only serve to improve the quality of life for the deer but also provide a model for other captive breeding programs aiming to optimize animal welfare.

Conflict of Interest

We certify that there is no conflict of interest with any financial, personal, or other relationships with people or organizations related to the material discussed in this manuscript.

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