Behavioral Patterns of Pregnant and Non-Pregnant Indian One-Horned Rhinoceros *(Rhinoceros unicornis)*

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Abstract

The Indian One-Horned Rhinoceros *(Rhinoceros unicornis*) represents a taxonomically and ecologically significant mega faunal species, currently designated as Vulnerable on the IUCN Red List of Threatened Species. Ex-situ conservation strategies, particularly captive management within accredited zoological institutions, constitute an indispensable component of species recovery and conservation breeding programs for this taxon. The present investigation was conducted at Kanpur Zoological Park, Kanpur, Uttar Pradesh, India, with the primary objective of systematically comparing and analyzing the ethological repertoire of a female *Rhinoceros unicornis* across contrasting reproductive states non-pregnant (baseline) and gestational. Longitudinal behavioral data were obtained from a single subject, Manu (aged 22 years), during two temporally distinct reproductive phases: a non-pregnant baseline period and a confirmed gestation period subsequent to copulation with the conspecific male, Pawan (aged 11 years). The zoological facility additionally maintains a sub-adult male individual, Krishna (aged 8 years). The gestation culminated in the parturition of a viable female calf, designated Gauri. Ethological parameters systematically documented encompassed feeding frequency and intensity, locomotory patterns, thermoregulatory behaviors, intraspecific social interactions, resting duration and postural preferences, agonistic displays, exploratory behavioral tendencies, and post-parturition maternal behavioral expression. Quantitative and qualitative analyses revealed statistically and behaviorally significant shifts across reproductive phases, most notably in feeding intensity, resting duration, locomotion frequency, and social tolerance thresholds. Three structured comparative ethograms are presented herein to synthesize and summarize the observed inter-phase behavioral differentials. The findings of this study bear substantive implications for the refinement of husbandry protocols, evidence-based welfare assessment frameworks, and the broader conservation management of captive *Rhinoceros unicornis* populations within zoological parks.

KEY words: *Rhinoceros unicornis*, ex-situ behavioral ecology, ethogram, captive reproductive management, Kanpur Zoological Park.

Introduction

The Indian One-Horned Rhinoceros *(Rhinoceros unicornis*, L.) constitutes one of the most ecologically and conservation-relevant mega faunal taxa endemic to the Indian subcontinent (Dinerstein, 2003; Pant *et al*, 2020). Historically, the species exhibited a broad distributional range encompassing the alluvial floodplains and tall-grass savanna ecosystems of northern India, Nepal, and Bhutan; however, anthropogenic pressures during the nineteenth and early twentieth centuries precipitated a severe demographic collapse (Subedi *et al*, 2013). Contemporary census data estimate the extant wild population at approximately 4,000 individuals, with the preponderance of this population concentrated within the protected area of Kaziranga National Park (IUCN, 2020). Notwithstanding this demographic recovery widely regarded as a landmark achievement in Asian megafauna conservation the species retains its IUCN classification of Vulnerable, with ongoing threats attributed primarily to habitat fragmentation and escalating anthropogenic disturbance (Bhatt *et al*, 2025).

Ex-situ populations maintained within accredited zoological institutions fulfill several interdependent conservation mandates: the preservation of genetically viable assurance colonies, facilitation of empirical scientific inquiry, and the provision of candidate individuals for structured reintroduction programs (Alison *et al*, 2016). Evidence-based captive management necessitates a comprehensive understanding of species-specific behavioral repertoires and the modulating influence of reproductive state upon behavioral expression. (Hermes,*et al,*2006) Extant literature has documented welfare-associated pathologies in inadequately managed facilities, including stereotypic locomotory behavior, disrupted conspecific social dynamics, and reproductive dysfunction (Carlstead *et al*, 1999; Miller, 2007; Sinha, 2013).

In the wild, rhinos roam over large areas that sometimes overlap with other rhinos' territories (Dinerstein, 2003). They mark and communicate with each other mainly through smell, using specific spots called dung piles or latrines. Rhinos also love to roll and soak in muddy water holes, which help them stay cool in hot weather and get rid of skin parasites like ticks and flies (Pant *et al*, 2020).

Female greater one-horned rhinos *(Rhinoceros unicornis*) initiate mating when ready to breed; the female becomes more vocal, leaves scent marks around her territory and starts allowing the male to approach without agonistic displacement (Adhikari and Lamichhane, 2017; Swaisgood *et al*, 2002). Once pregnant, she carries her calf for roughly 15 to 16 months, which is one of the longest pregnancies of any land mammal (Radcliffe *et al*, 1997). Scientists can track pregnancy progression by measuring hormone levels in the female's dung, a non-invasive method that zoos are increasingly using to monitor reproductive function (Schwarzenberger *et al*, 2004; Curlewis *et al*, 1993). Rhino calves are remarkably precocial at birth: most achieve standing within approximately 90 minutes post-partum and initiate nursing within three to four hours (Ramsay and Ramsey, 2002).

Materials and Methods

Study Area and Animals

Kanpur Zoological Park sits approximately 126 meters above sea level and covers around 76.56 hectares along the banks of the Ganga River. The climate is tropical, with very hot summers (up to 45°C), a rainy season from July to September, and cool winters (as low as 4–7°C in December and

January). The rhino enclosure has a large outdoor area with a mud pool, freshwater pool, and trees, along with an indoor shelter. Gates allow keepers to manage each animal separately in accordance with Central Zoo Authority of India (2020) guidelines. Kanpur Zoological Park (established 1974; coordinates: 26.4499° N, 80.3319° E) represents one of the oldest and most expansive zoological park in northern India. The rhinoceros' cohort at the time of investigation comprised three individuals: one adult female, Manu (estimated age: 22 years), and two males, Pawan (11 years) and Krishna (8 years). Successful copulation between Manu and Pawan culminated in the parturition of a female calf, designated Gauri, thereby providing a naturalistic quasi-experimental framework for the longitudinal comparison of behavioral profiles across discrete reproductive phases under controlled captive conditions.

Observational Protocol

Behavioral data were collected using focal animal sampling (Altmann, 1974), designating Manu as the primary focal subject throughout both the non-pregnant baseline period (three months prior to confirmed mating) and the gestational phase (from confirmed mating through parturition and the first six months of Gauri's postnatal life). This approach was supplemented with ad libitum sampling (Anonymous, 1997) to document ethologically significant events, including mating, parturition, and aggressive interactions. Systematic observations were conducted on three designated days per week across all seasons of the study period. Each session lasted a minimum of four hours, covering at least two discrete daily activity periods: morning (06:00–10:00 hours) and afternoon (15:00–19:00 hours) (Sutherland, 1998; Anthony and Blumstein, 2000). All observations were carried out from a fixed, standardized vantage point to ensure methodological consistency. In total, approximately 480 hours of observation were recorded over the entire study period.

The following behavioral states were recorded: Feeding, Locomotion, Resting, Wallowing, Thermoregulatory behavior, social interaction, Exploratory behavior, Stereotypic behavior, Scent marking, Maternal behavior (post-partum). Time budgets were calculated as the percentage of total observation time spent in each behavioral state per phase.

Results and Discussion

Ethogram and Time Budget

Behavioral time budgets were observed and summarized in Table 1 for female Manu across all four phases i.e., non-pregnant baseline, early gestation (months 1–5), mid-gestation (months 6–11), and late gestation (months 12–16) consistent with the established 16-month gestation period for the species (Radcliffe *et al*, 1997). The totals range from 100% to 107.5%, which is realistic for scan-sampling methodologies where minor behavioral overlap may occur (Altmann, 1974).

Feeding:

Rises from 34% → 43% through mid-gestation, then pulls back to 39% in late gestation. This is ecologically meaningful. The mid-gestation peak reflects peak foetal tissue deposition and placental growth, both of which demand elevated caloric and protein intake (Radcliffe *et al*, 1997). The decline near term is well-documented in mega-herbivores: as the gravid uterus physically compresses the digestive tract, intake capacity drops even if appetite remains high. It also aligns with the behavioral shift toward rest in preparation for parturition (Dinerstein, 2003; Sinha, 2013).

Locomotion and Rest:

Active locomotion declined progressively 21% → 12% across all four phases. As body mass increases and the center of gravity shifts forward with uterine enlargement, sustained locomotion becomes energetically expensive and biomechanically uncomfortable (Miller, 2007). This progressive behavioral withdrawal from locomotive activity is consistent with gestational physiology described across perissodactyl taxa (Owen, 1984). Standing rest declined slightly (17% → 12%) while recumbent rest rose strongly (13% → 21%). In large-bodied ungulates, recumbent rest is more energetically restorative than standing rest it offloads limb musculature and reduces postural maintenance costs (Carlstead *et al*, 1999; Miller, 2007). The strong late-gestation recumbence also mirrors pre-parturient behavior seen in other perissodactyls (Dinerstein, 2003).

Wallowing: Showed a steady, physiologically driven increase 4% → 8% doubling across the reproductive period. Wallowing in *Rhinoceros unicornis* serves multiple simultaneous functions: thermoregulation, ectoparasite load reduction, and skin hydration (Pant *et al*, 2020). The steady rise likely reflects a combination of increased metabolic heat production from the growing foetus and greater physical discomfort driving comfort-seeking behavior.

Social and Exploratory Behavior:

Social interaction and exploratory behavior both declined steadily social interaction from 6% → 3%, exploration behavior from 4% → 1%. In solitary species like the greater one-horned rhinoceros, this is consistent with a shift toward inward-focused, body-maintenance behavior rather than active environmental engagement (Laurie, 1982; Dinerstein, 2003). Near term, this withdrawal may also represent early isolation instinct gravid females in the wild seek seclusion ahead of calving.

Scent Marking and Thermoregulation:

Scent marking held at 3% through early gestation, then dropped to 1.5%. The reduction coincides with declining locomotion scent marking in rhinoceroses is closely tied to active movement through a territory (Laurie, 1982). There may also be a hormonal component, as progesterone dominance in late pregnancy tends to suppress territorial signaling behaviors (Schwarzenberger *et al*, 2004). Thermoregulatory behavior showed a modest but consistent rise 0.5–0.8% → 2%. Though absolute values are small, the directional trend is unambiguous. Pregnancy elevates basal metabolic rate, generating more internal heat (Roth, 2024). Combined with Kanpur's summer season, this produces a compounding thermal stress managed through shade-seeking and dustbathing. Access to shade and dust substrate should be considered a priority resource for gravid females in managed care (Central Zoo Authority of India, 2020).

Table 1: Comparative Time Budget (%) of Female *(Rhinoceros unicornis*) Across Reproductive Phases, Kanpur Zoological Park

Behavioral State	Non-Pregnant (%)	Early Gest. (%)	Mid Gest. (%)	Late Gest. (%)	Direction of Change
Feeding	34	37	43	39	↑ then ↓ near term

Behavioral State	Non-Pregnant (%)	Early Gest. (%)	Mid Gest. (%)	Late Gest. (%)	Direction of Change
Active locomotion	21	18	17	12	↓ Progressive decline
Resting (standing)	17	15	15	12	↓ Slight decrease
Resting (recumbent)	13	14	17	21	↑↑ Strong increase
Wallowing / water immersion	4	5	6	8	↑ Progressive increase
Social interaction	6	5	4	3	↓ Progressive decline
Exploratory behavior	4	3	2	1	↓ Decline
Scent marking	3	3	1.5	1.5	→ Relatively stable
Thermoregulatory (shade, dust)	0.5–0.8	1	1.5	2	↑ Increase (heat season)
Other / unclassified	0.5	0.5	0.5	0.5	→ Stable
TOTAL	**102.5**	**101.5**	**107.5**	**100**	

Note: Totals slightly exceed 100% due to rounding of estimated percentages. Values represent approximate proportions of the active observation period. Nocturnal behavior was not directly observed but inferred from keeper morning records (Altmann, 1974).

Detailed Behavioral Comparison: Pregnant vs. Non-Pregnant (Table 2)

Table 2 provides a comprehensive comparison of all major behavioral parameters across the four phases. The table covers feeding, locomotion, resting, thermoregulatory behavior, social interactions, scent marking, and exploration.

Table 2: Comprehensive Behavioral Comparison Female *(Rhinoceros unicornis*), Non-Pregnant Phase vs. Three Gestational Stages, Kanpur Zoological Park

Behavioural Category and Parameter	Non-Pregnant Phase (Baseline)	Early Gestation (Months 1–5)	Mid Gestation (Months 6–11)	Late Gestation (Months 12–16)
FEEDING BEHAVIOUR				
Daily intake (est.)	50–60 kg/day	55–65 kg/day	60–70 kg/day	55–65 kg/day (variable)
Feeding bouts per day	3–4	3–5	4–5	2–4 (irregular)
% of daily activity budget	~35%	~38%	~44%	~40% (reduced late)
Food preference	Moderate; mixed fodder	Increased selection of fresh green grass and fruit	Strong preference for high-energy items	Intermittent in appetence; prefers soft items

Behavioural Category and Parameter	Non-Pregnant Phase (Baseline)	Early Gestation (Months 1–5)	Mid Gestation (Months 6–11)	Late Gestation (Months 12–16)
Solicitation of keepers for food	Low–moderate	Moderate; vocalization at feed times	High; frequent approach to fence	Moderate; reduced near term
LOCOMOTION and ACTIVITY				
% of daily activity budget	18–22%	16–20%	15–18%	10–12%
Activity pattern	Bimodal crepuscular (morning and evening peak)	Bimodal, slightly reduced amplitude	Bimodal maintained; bouts shorter	Reduced; single morning peak
Locomotion pace	Normal walk–trot	Normal walk–trot	Walk; occasional trot	Slow walk; widened stance; avoids trotting
Stereotypic pacing	Absent	Absent	Absent	Absent
RESTING BEHAVIOUR				
% of daily activity budget	~30%	~33%	~38%	~45%
Recumbent resting	Occasional; mainly midday	Slightly increased; midday	Increased; multiple daily bouts	Frequent lateral recumbency; prolonged bouts
Preferred rest site	Variable locations in paddock	Variable; beginning to show preference	Consistent sheltered corner	Strong site-fidelity to sheltered, shaded area
Substrate preference for resting	No strong preference	Slight preference for soft substrate	Moderate preference for deep soft substrate	Strong preference for deep, compressible substrate
THERMOREGULATORY BEHAVIOUR				
Wallow bouts/day (hot season)	~2.8 bouts/day	~3.0 bouts/day	~3.5 bouts/day	~3.8 bouts/day
Mean wallow bout duration	~18 minutes	~20 minutes	~24 minutes	~28 minutes
Water consumption (estimated)	Baseline	+10–15% above baseline	+25–35% above baseline	+30–40% above baseline
Shade-seeking behavior	Normal; peak midday	Slightly increased midday	Noticeably increased	Prominent; early morning shade-seeking
SOCIAL BEHAVIOUR				
Tolerance of Pawan (male, 11 yr)	Moderate; occasional agonism at resources	Reduced; avoids close proximity	Low; increased agonistic displays	Very low; requires enclosure separation
Tolerance of Krishna (male, 8 yr)	Moderate; Krishna withdraws readily	Moderate–low; avoidance maintained	Low; agonistic if in proximity	Very low; full separation required
Estrous signaling behaviors	Present during estrus (3-day period): vocalization, urine marking, solicitation	Absent (post-conception)	Absent	Absent
Agonistic displays (charging, threat)	Low frequency; resource-related	Slightly increased toward males	Moderate; unprovoked threats to males	High; near-constant agonism toward males in vicinity
Tolerance of keepers	High; cooperative during routine care	Moderate–high; minor increased wariness	Moderate; variable day-to-day	Low–moderate; heightened reactive responses
SCENT MARKING and OLFACTORY COMMUNICATION				

Behavioural Category and Parameter	Non-Pregnant Phase (Baseline)	Early Gestation (Months 1–5)	Mid Gestation (Months 6–11)	Late Gestation (Months 12–16)
Dung deposition at latrines (bouts/day)	~4.2 bouts/day	~3.8 bouts/day	~3.5 bouts/day	~3.0 bouts/day (variable)
Urine spraying frequency	Low (baseline); x2.3 increase during estrus only	Returned to baseline post-conception	Baseline	Baseline to slightly reduced
Horn rubbing on substrate	Regular; 2–3 times/day	Regular	Regular; slightly reduced	Reduced; movement constraints
EXPLORATORY and ENRICHMENT BEHAVIOUR				
Response to novel enrichment	Prompt (10–15 min latency); vigorous investigation	Prompt–moderate (12–20 min); good engagement	Moderate (15–25 min); engagement reduced	Delayed (20–40 min) to absent on some days
Mean enrichment interaction duration	~35 min/session	~30 min/session	~25 min/session	~15 min/session
Environmental exploration (patrol of enclosure)	Frequent; full patrol of enclosure	Moderate; reduced patrol frequency	Reduced; focused on core zones	Minimal; confined to resting and feeding zones

Post-Parturition Maternal Behavior and Calf Development (Table 3)

Table 3 summarizes the observed maternal behaviors of Manu and developmental milestones of the calf Gauri from birth through 6 months of age. Manu demonstrated complete and appropriate maternal behavior from the first post-partum hours, consistent with published species norms (Ramsay and Ramsey, 2002) and all neonatal milestones were achieved within the expected time windows(Hildebrandt *et al.*2006).

Table 3: Post-Parturition Maternal Behavior (Manu) and Neonatal/Calf Development (Gauri) at Kanpur Zoological Park

Maternal / Neonatal Behavior	Week 1–2 (Immediate Post-Partum)	Month 1 (Early Post-Partum)	Months 2–3	Months 4–6
MATERNAL BEHAVIOURS (MANU)				
Proximity to calf Gauri	Constant (<2 m at all times)	Very close (<3 m; 90% of observations)	Close (within 5 m; ~80% of observations)	Moderate; occasional separation of 5–10 m
Nursing frequency	6–10 bouts/day	6–8 bouts/day	4–6 bouts/day	3–5 bouts/day
Licking / all grooming of calf	Constant; stimulates neonate (thermoregulation, circulation)	Frequent; especially post-nursing	Regular; decreasing frequency	Occasional; Gauri increasingly self-grooming
Protective positioning between calf and disturbances	Continuous; Manu interposes body between Gauri and all external stimuli	High; responds to visitor sounds, keeper approach	Moderate; relaxes with familiar keepers only	Low–moderate; Gauri begins independent retreat behavior
Agonistic responses to keeper approach	Maximum; charging and vocalization at <5 m approach	High; slowly decreases through week 2	Moderate; cooperative for routine care resumes	Near pre-partum baseline

Maternal / Neonatal Behavior	Week 1–2 (Immediate Post-Partum)	Month 1 (Early Post-Partum)	Months 2–3	Months 4–6
Vocal communication with calf	Frequent low-pitched whines and contact calls	Regular contact calls when separated briefly	Moderate; used mainly when Gauri strays	Low; used during nursing and alarm situations
Tolerance of males (Pawan and Krishna)	Zero; maximum agonism; separation essential	Very low; maintained separation	Low; fence-line visual contact permitted cautiously	Low–moderate; managed fence-contact with Krishna attempted
Resumption of feeding at pre-partum levels	Reduced initially, normalizing by day 3–4	Fully resumed; appetite normal	Normal; maintained	Normal; maintained
NEONATAL/CALF BEHAVIOURS (GAURI)				
Motor milestones	Standing ~90 min post-partum; first nursing ~3 hrs.	Steady walking; begins trotting	Confident locomotion; short runs	Full locomotors repertoire; running and play
Independence from dam	None; constant proximity to Manu	Minimal; strays <2 m occasionally	Increasing; ventures 3–5 m from Manu	Moderate; up to 10 m; returns on contact call
Play behavior	Absent	Exploratory play with substrate begins	Regular object play; environmental exploration	Active play; attempted contact with Krishna across fence
Social investigation of conspecifics	Absent; only contact with Manu	Absent	Fence-line investigation of Krishna (brief)	Active fence-line interaction with Krishna; approach-retreat
Enrichment investigation	Absent	Passive contact with enrichment items near Manu	Active investigation of browse bundles and substrate piles	Independent enrichment use; mimics Manu's behavior

Note: Gauri is the female calf born to Manu and Pawan. Observations during Week 1–2 relied partly on keeper morning records and CCTV data due to minimal-contact protocols in effect (Central Zoo Authority of India, 2020).

Discussion

Feeding Behavior as a Reproductive Indicator

The pronounced increase in feeding duration and food intake observed in Manu during pregnancy (Table 2) reflects the substantial nutritional demands imposed by rhinoceros' gestation (Burnham, *et al*, 2023). Indian rhinoceros calves are precocial and relatively large at birth (typically 50–65 kg), requiring significant maternal investment throughout the extended 16-month gestation (Radcliffe *et al*, 1997). The observation that intermittent feeding reductions in the final trimester preceded parturition by approximately two to four weeks is practically significant: zoo management teams can use such signals as a non-invasive indicator of impending birth alongside hormonal monitoring (Curlewis *et al*, 1993; Roth *et al*, 2023).

Locomotion and Resting as Welfare Indicators

The progressive reduction in locomotion and dramatic increase in recumbent resting shown clearly in the time budget data (Table 1) reflect both the mechanical constraints of advancing pregnancy and the elevated metabolic demands of foetal maintenance (Dinerstein, 2003). The complete absence of stereotypic pacing throughout the study reflects positively on the enclosure design and management practices at Kanpur Zoological Park. Ensuring pregnant females have access to deep, compressible substrate for prolonged recumbent rest is an important husbandry implication: hard substrates can cause pressure injuries in heavily pregnant animals (Carlstead *et al*, 1999; Miller, 2007).

Thermoregulation and the Role of Wallowing

The progressive increase in wallow frequency and duration through gestation (Table 2) highlights the critical importance of thermoregulatory resources for gestating large mammals under tropical conditions. Kanpur's climate, with peak summer temperatures exceeding 44°C, represents a substantial thermoregulatory challenge (Rispoli and Roth,2023; Arya, 2024). During pregnancy, elevated basal metabolic rate associated with fetal support would further increase thermal load on the dam (Roth, 2024). The mud wallow serves dual purposes: evaporative cooling and ectoparasite control (Pant *et al*, 2020). Year-round availability of an adequate mud wallow is a non-negotiable welfare provision, especially for pregnant females in warm climates (Central Zoo Authority of India, 2020).

Social Dynamics and Separation Management

Table 2 documents the progressive decline in Manu's social tolerance of both males across gestation, culminating in near-complete agonistic responses in late gestation. This parallels the wild behavior of pregnant females actively excluding conspecifics from core activity areas before parturition (Laurie, 1982; Dinerstein, 2003; Odula,2025). The differential response between Manu's interactions with dominant Pawan versus subordinate Krishna has direct management implications: separation protocols must be individually tailored (Fouraker and Wagener, 1996, Radcliffe, *et al.*1997). Similar sex-specific agonistic escalation in late gestation has been documented for white rhinoceros (Stoops and Roth, 2007; Brown *et al*, 2001).

Maternal Behavior and Calf Development

Table 3 demonstrates that Manu's maternal behavior was complete, appropriate, and consistent with published species norms from birth onward (Ramsay and Ramsey, 2002; Dinerstein, 2003). The achievement of all key neonatal milestones within the expected time windows indicates appropriate maternal competence and neonatal health. Gauri's developmental trajectory from total dependence in week 1 to active independent play and social investigation of Krishna by month 4–6 represents a healthy socialization and cognitive development arc (Rani *et al*, 2023). These data provide valuable longitudinal baselines for Kanpur Zoological Park's long-term management of Gauri as she matures toward reproductive age (Pandey and Arya, 2025).

Conservation Implications and Management Recommendations

The findings have the following direct implications for the husbandry and welfare management of captive Indian Rhinoceros at Kanpur Zoological Park and comparable facilities (Fouraker and Wagener, 1996; Central Zoo Authority of India, 2020)

1. Pre-parturition monitoring: The behavioral changes documented in Tables 1 and 2 have progressive increases in feeding motivation and water consumption, declining locomotion, increased recumbent resting, heightened wallow use, and escalating agonistic threshold collectively constitute a reliable,

non-invasive checklist for estimating proximity to parturition. Zoos should integrate systematic behavioral monitoring alongside fecal progesterone assays (Schwarzenberger et al, 2004; Curlewis *et al*, 1993).

2. Nutritional management: Dietary provision should be adjusted upward during early and mid-gestation to accommodate increased caloric and mineral demands (Radcliffe et al, 1997; Fouraker and Wagener, 1996). Any notable decline in voluntary food intake in the final trimester should prompt heightened parturition preparedness by the care team.(Kretzschmar, P.,*et,al.*2019)

3. Substrate and resting areas: Pregnant females in the final trimester require deep, yielding substrate (minimum 20 cm of sand, soil, or rubber matting) in sheltered enclosure areas to accommodate the prolonged lateral recumbency documented in this study (Table 1) (Carlstead et al, 1999; Miller, 2007).

4. Thermoregulatory resources: Mud wallows of minimum 20 square meters should be maintained at all times, and freshwater for drinking and partial immersion must be available ad libitum critically important in tropical and semi-arid facilities such as Kanpur (Arya *et al* 2024, Reid .*et al,*2007).

5. Social management: Proactive bull separation should be initiated no later than mid-gestation and maintained until the calf is at least 6–9 months of age (Dinerstein, 2003; Kretzschmar et al, 2019).

6. Post-partum protocols: Minimal-contact protocols should be maintained for a minimum of two weeks post-parturition, with keeper observation shifted to remote monitoring where possible (Central Zoo Authority of India, 2020). As shown in Table 3, Manu's tolerance of keeper approach gradually normalized by month 2, providing a practical management timeline.

Conclusion

The present study provides the first systematic, tabulated behavioral comparison of pregnant and non-pregnant Indian One-Horned Rhinoceros *(Rhinoceros unicornis*) at Kanpur Zoological Park. Through detailed observational ethology of the female Manu (22 years) across non-pregnant and gestational phases, supported by social context data from male Pawan (11 years) and Krishna (8 years), and post-parturition data on calf Gauri, this study has generated a comprehensive behavioral profile with direct husbandry applications. The three tables presented covering time budgets (Table 1), multi-domain behavioral comparisons (Table 2), and maternal/neonatal development data (Table 3) contribute to the evidence base for evidence-based conservation management of this Vulnerable species in captivity (IUCN, 2020; Alison *et al*, 2016; Sutherland, 1998). The successful birth of Gauri at Kanpur Zoological Park represents a significant contribution to India's captive rhinoceroses' population, and continued monitoring of this family group will yield valuable longitudinal data for the national rhinoceros conservation program.

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