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Field based standard operating procedure for reuniting Indian Leopard (*Panthera pardus fusca*) cubs in Maharashtra, India: Consolidating years of successful practice

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Abstract

Indian Leopard (*Panthera pardus fusca*) cubs are frequently separated from their mothers due to natural calamities, human interference, or habitat encroachment, necessitating timely intervention to facilitate effective reunification. This report documents 73 successful reunions involving 112 leopard cubs between 2009 and 2024 across the districts of Ahmednagar, Pune, Satara, and Nashik in Maharashtra State, India. A standardized reunification protocol was developed and implemented, emphasizing rapid response, comprehensive health assessments, and specific procedures to maximize the chances of maternal retrieval. Community awareness initiatives were integrated to reduce human interference and enhance conservation outcomes. The results demonstrate that timely reunification guided by this protocol can successfully restore displaced cubs to their mothers, contributing to both species conservation and animal welfare. The protocol presented here has potential applications for other wild felid species.

Keywords: Human-leopard interaction, rescue, mother-cub reunion, wildlife rehabilitation, conservation awareness

1. Introduction

Separation and reunification are natural behaviors among many animal species, driven by various biological imperatives such as foraging, mating, or weaning (Boinski & Garber, 2000) [4]. However, young animals may also become separated from their mothers due to events such as natural disasters (Barman *et al.*, 2014) [3], human interference (McTurk & Spelman, 2005) [11], or maternal death resulting from hunting (Pajetnov & Pajetnov, 1998) [12] or natural causes (Singh *et al.*, 2011) [17]. Common responses to incidents include hand-raising and subsequent release in to wild, or long-term rehabilitation in sanctuaries or zoological facilities. Several hand raised species have been successfully rehabilitated in the wild, including the Asian Elephant (*Elephas maximus*; Perera *et al.*, 2018) [13], Indian Rhinoceros (*Rhinoceros unicornis*; Barman *et al.*, 2014) [3], Common Wombat (*Vombatus ursinus*; Saran *et al.*, 2011) [16], and Giant Otter (*Pteronura brasiliensis*; McTurk & Spelman, 2005) [11].

An alternative, less frequently implemented but potentially more effective approach for healthy, uninjured young animals is timely reunification with their mothers (Sparks & Casey, 1998) [18]. Documented successes include the reunification of Western Chimpanzee (Pruetz & Kante, 2010) [14], Giant Otter (Lima & Marmontel, 2011) [9] and the Rusty-spotted Cat (Deshmukh *et al.*, 2020) [6].

Among large carnivores, the Indian Leopard (*Panthera pardus fusca*), a Schedule I species under the Wildlife (Protection) Amendment Act, 2022, is classified as "Vulnerable" on the IUCN Red List (Stein, 2020) [19]. *P. pardus fusca* demonstrates wide geographic distribution and notable ecological adaptability. Nevertheless, its population has declined due to human-wildlife conflict (Thorn *et al.*, 2013) [21], habitat fragmentation (Qureshi *et al.*, 2024) [15] and illegal wildlife trade (Datta *et al.*, 2008) [5].

With an estimated 8,820 individuals, Central India holds the highest leopard population, while Maharashtra supports the second largest with approximately 1,985 individuals (Qureshi *et al.*, 2024) [15]. Despite its conservation significance, the reproductive biology and breeding patterns of wild Indian Leopards remain poorly documented.

In many cases, leopard cubs found in crop lands or tea gardens are mistakenly believed to be abandoned and are taken by locals (Ali, 2017) [1]. Timely reunification in such scenario is often the most appropriate conservation intervention. Although there are isolated reports of leopard cub reunions (e.g., in Assam; Gupta *et al.*, 2020) [7], no standardized operating protocol has been formally documented until now.

2. Study area

All reunion events were conducted in the districts of Ahmednagar, Pune, Satara, and Nashik in Maharashtra, India (Figure 1). This region forms part of the northern Western Ghats, characterized by undulating hilly terrain interspersed with valleys. The hills are predominantly covered with grasses and boulders, with sparse tree cover. Agriculture is primary livelihood with sugarcane, grapes, and onions being the major crops cultivated in valleys (Athreya *et al.*, 2011) [2]. The extensive sugarcane fields provide both habitat and cover for Indian Leopards (*Panthera pardus fusca*), contributing to

high leopard densities and frequent interactions with human communities (Jhamvar-Shingote & Schuett, 2013) [8].

3. Materials and Methods

In collaboration with the Maharashtra Forest Department, Wildlife SOS manages the Manikdoh Leopard Rescue Centre in Junnar, Pune district, which is dedicated to the rescue, rehabilitation, and release of conflict affected leopards since 2007. When leopard cubs were spotted by local residents (Figure 2), the information was conveyed to the Forest Department or directly to Wildlife SOS (Vijay Gonekar *et al.*, 2024) [20]. Subsequently, a Mobile Veterinary Unit (MVU) from Wildlife SOS was dispatched to the site for further assessment and intervention.

The cubs were transported in secure, well-ventilated wooden boxes (Figure 3) to the Wildlife SOS Multi-Speciality Hospital for clinical evaluation. Each cub underwent a comprehensive health check, including assessment for infections, injuries, and overall physical condition. If the cubs were deemed fit, the reunification process was initiated with minimal clinical intervention. Details such as the time of cub detection and the time of attempted reunion were carefully documented. In instances where reunification was not feasible due to compromised health, long-term rehabilitation strategies were adopted in the best interest of the cubs welfare.

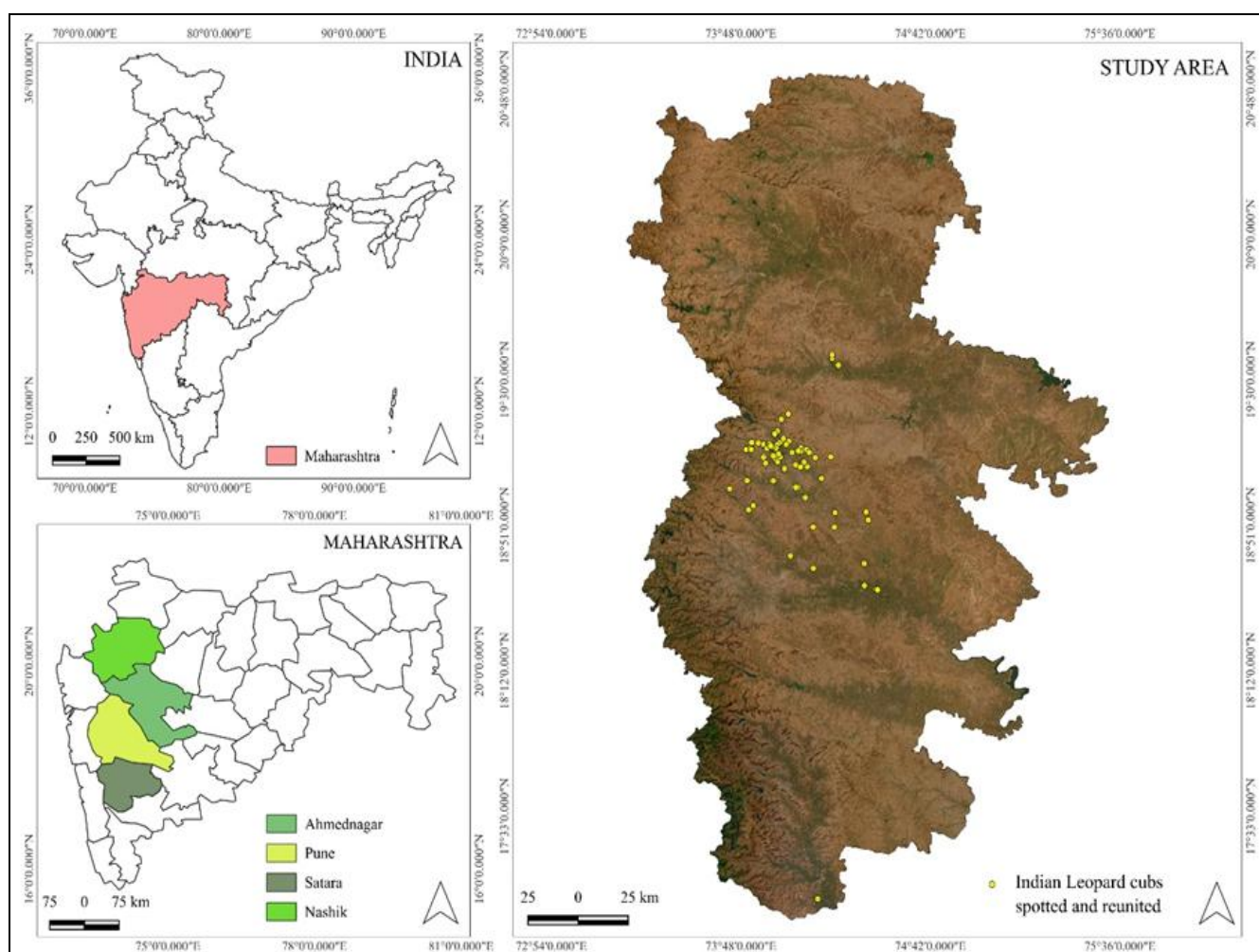


Fig 1: Map indicating the study area across four districts; Ahmednagar, Pune, Satara, and Nashik in Maharashtra, India



Fig 2: Two leopard cubs were discovered concealed within the dense foliage of a sugarcane field



Fig 3: Secure transportation of leopard cubs in a well-ventilated wooden box to the Wildlife SOS Multi-Specialty Hospital for clinical evaluation

3.1 Standard operating procedure established for reunion:-

1. **Timeliness:** The probability of a successful reunion decreases with prolonged separation. Immediate action is therefore critical.
2. **Minor injuries:** Cubs with superficial wounds or abrasions may be treated locally with appropriate wound care without delaying the reunion process.
3. **Dehydration management:** If cubs exhibit signs of dehydration, oral rehydration solutions (electrolyte and glucose-based) may be administered using a baby bottle fitted with a kitten-sized nipple.
4. **Nutritional support:** When nutritional intervention is necessary, a milk replacer such as Baby cat Milk (Royal Canin) can be used. The volume should not exceed 10% of the cub's body weight.
5. **Pre-reunion preparation:** To encourage vocalization, essential for maternal detection, feeding should be avoided 2-3 hours prior to the reunion. An empty stomach (only if medically safe and fit) promotes natural mewling behavior, increasing the chances of maternal retrieval.
6. **Timing of reunion:** Given the crepuscular and nocturnal activity patterns of leopards, reunification attempts should be conducted after sunset.
7. **Setup:** At dusk, the cub is placed in a well-ventilated transparent plastic box lined with hay and grass. The box should be elevated 1-2 feet above ground to enhance visibility and audibility, and to avoid waterlogging during rain. The box is gently covered and secured with a rubber brick, preventing cub escape but allowing dismantling by the mother. It is then placed at the exact location where the cub was originally found.
8. **Scent and hygiene:** Cubs may urinate or defecate in the box, which helps mask human scent. However, reasonable hygiene should be maintained.
9. **Monitoring:** Camera traps must be installed around the site to document maternal approach and the reunion process (Figure 4).
10. **Minimizing human disturbance:** All personnel must vacate the area promptly after setting up, to minimize stress and human scent interference.
11. **Post-reunion verification:** The following morning, the team revisits the site to verify if the cub remains in the box. If absent, camera trap footage is checked to confirm whether a successful reunion took place (Figure 7).



Fig 4: Installation of camera traps and elevated placement of the cub in a ventilated transparent plastic box lined with hay and grass

4. Results and Discussion

Between 2009 and 2024, a total of 112 leopard cubs were successfully reunited with their mothers across 73 documented reunion events (Figure 5). Among these, three events involved litters of four cubs, twelve litters comprised three cubs, fifteen litters included two cubs, and thirty-four litters had single cubs. All cubs were found in sugarcane fields, reinforcing previous observations that Indian leopards commonly utilize these fields as habitat due to the availability of dense cover and abundant prey (Jhamvar-Shingote & Schuett, 2013; Lorica & Heaney, 2013) [8, 10]

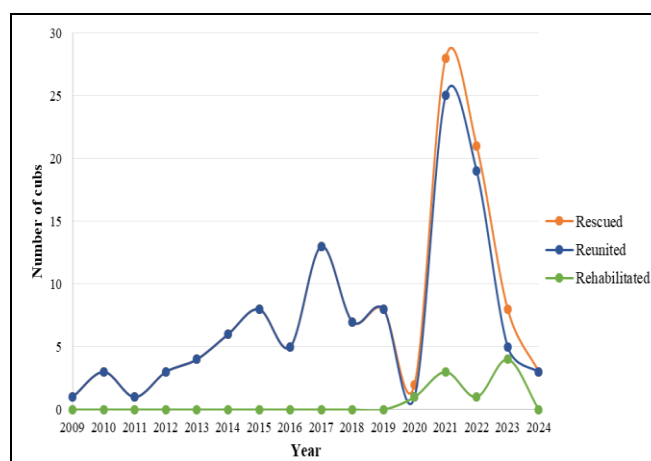


Fig 5: Trends in the number of leopard cubs rescued, reunited with their mothers, and rehabilitated from 2009 to 2024

Seasonal patterns revealed that the highest number of reunions occurred between November and May, coinciding with the sugarcane harvesting period in the region (Figure 6).

This suggests a clear link between agricultural activities and the frequency of cub sightings.

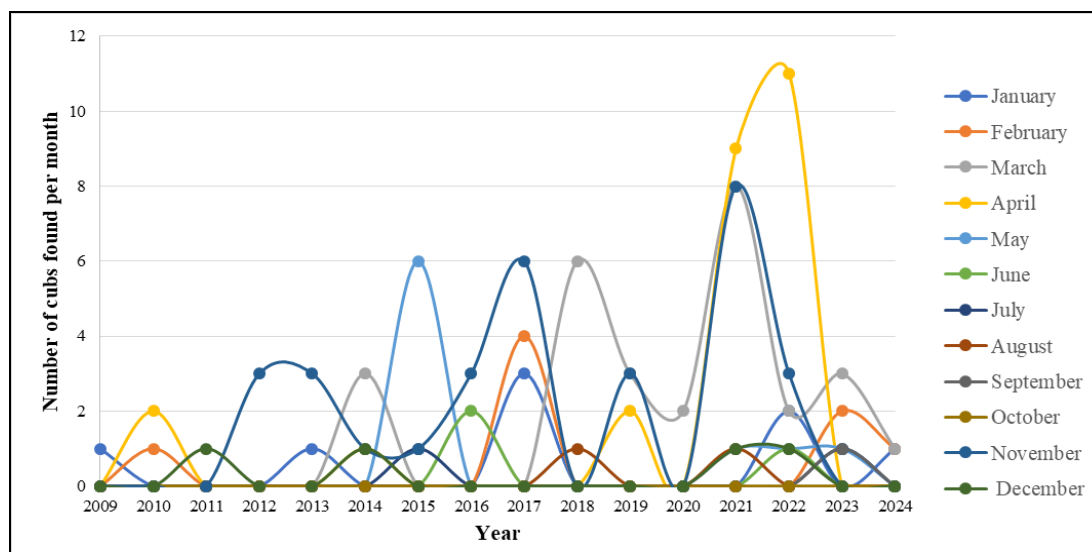


Fig 6: Monthly distribution of leopard cub sightings from 2009 to 2024, showing seasonal peaks between November and May

On average, rescue operations began around $13:35 \pm 1:18$ hours, while reunion attempts were carried out at approximately $22:20 \pm 1:19$ hours. The shortest time interval between rescue and reunion was 5 hours and 45 minutes, while the longest extended to 156 hours. In most cases, reunions were achieved within the same day. However, in a few instances, up to seven attempts were necessary to achieve a successful outcome. During the reunion process, the cubs

consistently displayed alertness and vocalized (mewed) upon detecting the approach of their mother. Maternal behavior was typically characterized by licking the cubs and gently picking them up in her mouth to relocate them (Figure 8). In cases involving multiple cubs, the mother was observed carrying them one at a time to nearby crop cover, returning for the remaining cubs. If the cubs were developmentally mature and mobile, they often followed the mother on foot.



Fig 7: Camera trap image showing maternal recognition, mother leopard interacting with and retrieving her cub



Fig 8: Camera trap image capturing the mother leopard gently carrying her cub in her mouth, demonstrating successful reunion behavior

Community engagement was an integral part of each rescue event. The Wildlife SOS team actively interacted with local residents to raise awareness about leopard behavior and advised them not to handle or relocate cubs, but to inform the appropriate forest authorities instead. Based on this decade-long experience, the authors conclude that the field-based Standard Operating Procedure (SOP) described here is highly effective in reuniting displaced Indian leopard cubs with their mothers. Furthermore, the methodology has potential for adaptation in the management and reunification of other wild cat species.

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Conflict of Interest

Not available

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Not available

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