

## Challenges faced in rehabilitating orphaned leopard cats (*Prionailurus bengalensis*) in Western Assam, India

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### Introduction

The leopard cat (*Prionailurus bengalensis*) is a widespread species found in most of the Indian subcontinent, Southeast Asia, China, the Korean Peninsula, and the Russian Far East.<sup>1</sup> In India, leopard cats are found in two distinct populations, one in the southern Western Ghats and the other in the Himalayas/Northeast India.<sup>2</sup> The small cat occurs in a broad spectrum of habitats, including tropical rainforests, shrub forests, open grasslands, and plantations.<sup>1</sup> Studies indicate that leopard cats can thrive on human-modified landscapes and have moderate dietary flexibility. Leopard cats mainly prey on murids (i.e., rodents) and other small mammals but can also take a variety of other prey like reptiles, amphibians, birds, and insects.<sup>3</sup> Their prey preference, like other carnivores, is thus dependent largely on prey availability and competition with sympatric

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### ABSTRACT:

The leopard cat (*Prionailurus bengalensis*) is one of the most widely distributed small cat species in the world. For the current study, 15 leopard cat kittens were hand raised between 2015 and 2021, and the challenges faced in rehabilitating the species were evaluated. During the hand-raising phase, 73% (11/15) of the leopard cat kittens survived, while four died. The average weight gain of the kittens was 10.5 ( $\pm 1.05$ ) g per day during the milk-dependent period and 14.7 ( $\pm 1.24$ ) g per day after the introduction of solid food. At the age of 6–7 mo, they were soft released at an appropriate site by first holding them in situ in an acclimatization cage for an average of 20 days. In the absence of radio transmitters, an attempt was made using camera traps to monitor the dependency of the released cats on the supplementary food being kept in the cage. However, no post-release photos of the cats were captured, as the cats did not come back to the cage and showed no fidelity, either to the acclimatization cage or to the food being provided. Post-release monitoring via radio or satellite telemetry would have provided information on the survival and spatial ecology of the individuals. For future studies, we recommend including this approach while hand-raising and releasing leopard cats back into the wild.

**KEYWORDS:** hand-raised, leopard cat, post-release monitoring, *Prionailurus bengalensis*, rehabilitation.

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**FIGURE 1.** Leopard cat kitten in rehabilitation.

predators.<sup>4</sup> While the trade for skin and bone, the pet trade, and retaliatory killing are threats to the species outside its range in India,<sup>5</sup> habitat fragmentation and, to an extent, hunting are also major threats to the populations in India. Though not as adapted as the jungle cat (*Felis chaus*), leopard cats are also known to use human-modified landscapes for their life sustenance activities, including breeding and reproduction.<sup>6,7</sup> These human-modified landscapes can provide two types of dens: natal dens, sites where altricial kittens are born and nurtured for 2–3 wk until they are mobile, and auxiliary dens, secondary sites where the young can safely be hidden, especially when the mother is away.<sup>8</sup> However, this adaptive strategy of the mother also puts the kittens in jeopardy of being located by humans, particularly when the mother leaves the den. Though small cats are known to reject their kittens during the neonatal period due to physical, biological, or physiological inabilities to successfully rear them,<sup>9</sup> the reason for the presentation of kittens at the rescue center is the unwanted intervention of misinformed villagers picking up the kittens.<sup>10</sup> In such cases, all attempts are made to reunite the kittens with the mother. When attempts at reunion fail, the kittens are either taken to lifetime care centers like zoos or inducted into a holistic rehabilitation program to pursue a return-to-the-wild option.

The International Fund for Animal Welfare (IFAW) and Wildlife Trust of India (WTI) operate a Mobile Veterinary Service (MVS) unit at the Bodoland Wildlife Transit Home, Charaikhola, Kokrajhar, Assam, India. The unit is a satellite station of the Centre for Wildlife Rehabilitation and Conservation (CWRC), Kaziranga National Park, a joint facility established by IFAW and WTI in collaboration with the Assam Forest Department. The CWRC and its allied MVS units, like the one at Kokrajhar, assist the forest department in responding to wildlife emergencies that

include wildlife displacements of various kinds. The main focus of the mobile veterinary unit is to provide optimum veterinary care to the displaced animal, address its welfare needs, and eventually return it back to the wild using scientific methods.

### Rescue history

Between January 2015 and May 2021, the MVS station handled 15 leopard cat kittens from various parts of Western Assam. Eight of these kittens were admitted as individuals (Fig. 1), while seven were presented in litters of two or three individuals. On arrival,

they were checked for injury and other physiological parameters. Preliminary treatments for dehydration were provided, and the kittens were kept in a plastic basket in preparation for a possible reunion with the mother. In all the cases except one (where the mother was confirmed dead), the team attempted to reunite the kitten with the mother by placing the kitten at the site of rescue for 24 hr. If the mother is close, the cries of the kittens are enough to attract the mother back. Camera traps were set up to record the mother's return. Having failed to reunite, the kittens were hand-raised for release back to the wild. All the kittens were estimated to be older than 2 wk of age (eyes open, able to ambulate) except for two kittens less than 2 wk old (eyes closed).

### Methods

The entire process of nursing, release, and post-release monitoring was conducted according to the guidelines outlined in the IFAW–WTI protocol on small carnivore rehabilitation.<sup>11</sup>

### Housing

For about the first month post-admission, the kittens were held in a medium-sized cage (L 4 ft × H 3 ft × W 3 ft) to facilitate close observation and care. Due to their ease of cleaning and disposable nature, soft blankets were provided as a substrate inside the cage. The hollow of a tree trunk was placed inside the cage and used as a refuge den. The cage, with all its furnishings, was kept in a well-ventilated small animal nursery room. After a month, the kittens were shifted to the outdoor enclosure (L 22 ft × H 10 ft × W 11 ft) when they were estimated to be about 2–3 mo of age or weighed over 1 kg. This was designed to give sufficient space for mobility, overall bone and muscle development, and gradual reduction of human contact to avoid habituation.<sup>12</sup> Tree branches,

tree stalks, and a refuge den provided furnishings. The enclosure was situated at a remote location with minimal human exposure.

### Feeding

The kittens were bottle-fed in the ventral position to avoid aspiration. A nursing kit meant for small animals was used. For the first 24 hr of admission, the kittens were fed fluids (Ringer's lactate mixed with 25% dextrose). The kittens were fed every 2–3 hr (around eight feedings/day), and the volume fed for the entire day equaled 12–18% of their body weight as per available literature.<sup>9</sup> Unavailability of a suitable commercial milk replacer was the biggest challenge for the authors in the rehabilitation of the rescued kittens. This lack of milk replacer in the local market made cow's milk the next best option. (However, with increased demand and supply in the growing pet market, commercial milk replacers are now being used for all newly rescued kittens.) Cow's milk was fed till the age of weaning (8 wk). The milk was first boiled, then cooled and fed when it was lukewarm (20–30°C). Bottles and nipples were thoroughly washed and sterilized before every feeding. To encourage defecation and urination, anal stimulation using wet cotton was done after every feeding.<sup>13</sup> Milk was slowly tapered off from bottle to pail while being supplemented with egg yolk for additional protein and fat; eventually, milk and supplements were replaced by solid foods completely. Visceral organs (liver), small bones, and large muscles of chicken, lamb, and pork were given for natural supplementation of essential nutrients. Meat was provided in a quantity limited to about 20% of the body weight once a day without following any definite time frame to prevent the development of food anticipatory behavior.

### Behavioral enrichment

Once the kittens were weaned, live prey in the form of rodents and

young chickens were provided to them twice a week to provide opportunities for honing their hunting skills. The cats, at the age of 3 mo onward, gradually learned to stalk the prey animals swiftly, capture and kill them, and skin and devour them. By this time, human contact was completely removed, and only remote feeding was done. A remote camera was placed to record the hunting behavior. The animals were considered to be fit for release into the wild only after they learned to skillfully hunt the given prey. Kittens of similar age groups were kept together in the same enclosure to avoid boredom and encourage social learning. Though the kittens were initially reluctant to interact with each other, they soon started to use the same refuge den after spending around a week of time together.

### Veterinary care

Upon admission, an oral electrolyte solution (FDC Ltd., India) was offered for mild to moderately dehydrated kittens, and a Ringer's lactate solution (Parenteral Pvt. Ltd., India) was given intravenously in severe cases. Constipation is a common digestive problem during hand rearing with the new milk formula/diet.<sup>14,15</sup> Digestive stimulants, Digyton drops (Himalaya, India) at 4–5 drops, twice a day after food, were given orally to prevent flatulence. Periodical deworming was done with Albendazole at 10 mg/kg body weight or a combination of Praziquantel and Fenbendazole tablets given orally following stool examination. Extra vitamins and supplements (Ostopet, Virbac, India, and Zipvit, Intas, India) were prescribed for the kittens to prevent vitamin deficiency and ensure proper bone health and growth. Kittens were vaccinated with a modified live vaccine, Feligen® CRP (Virbac, India), to protect against the diseases caused by feline calicivirus, feline viral rhinotracheitis, and panleukopenia virus. They received their first dose at an age of around 8–10 wk and a booster dose at 4–5 mo of age. A complete

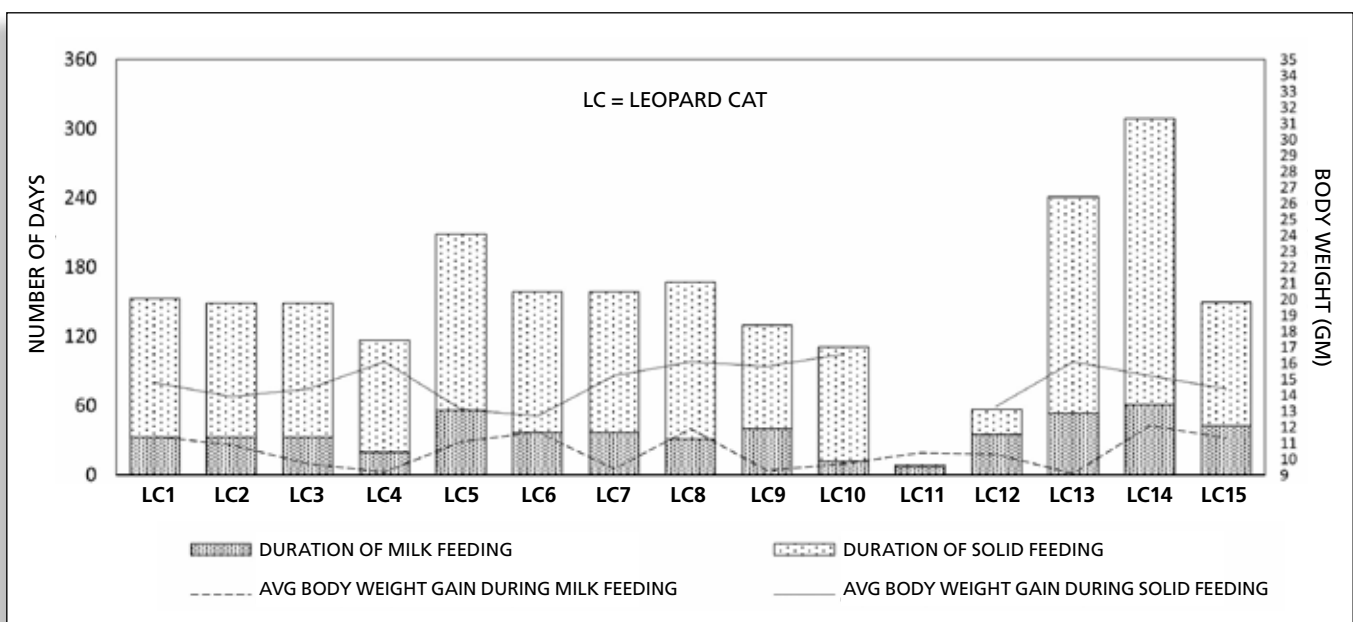


FIGURE 2: Duration of milk and solid feeding versus bodyweight gain of leopard cats.

blood count and serum chemistry were examined for each individual before releasing them back into the wild.

### ***Acclimatization and release***

A suitable release site was selected after careful consideration of habitat suitability, threats, availability of prey, and proximity to the original capture/rescue site. All the cats above 5 mo of age, weighing close to 2 kg and above, were taken to the release site for acclimatization through temporary accommodation. In situ acclimatization is essential to develop the released individual's fidelity/philopatry to the release site and consequently prevent or minimize sudden post-release dispersal. A soft release by in situ acclimatization also helps in the gradual familiarization of the released individuals to the release site and the reduction of dependence on humans. At the release site, the cats were kept in a medium-sized welded mesh cage (L 4 ft × H 3 ft × W 3 ft) for varying periods (7–30 days) to become acclimatized to the wild environment. Daily they were given adequate water and food. Human exposure was kept to a minimum. After the acclimatization period was over, the door was kept open for the animals to move out into the wild. Supplementary food was continued in the cage for a week to support the cats till they could get established at the new site.

### **Post-release monitoring**

In the absence of radio or GPS collars, post-release monitoring of the released cats was done using a series of camera traps set near the feeding area and probable trails. Camera traps were placed near the cage door as well as nearby trails to record the moving out and returning of the cat to the cage to see if they were still returning to the cage for food. Due to the lack of financial support, radio transmitters and other active transmission devices could not be used. All the animals were microchipped before release to verify the individual identity in times of opportunistic recapture or death. Secondary information also gathered were impression pads in the sand near the enclosure site.

### **Results**

Seventy-three percent (11/15) of the leopard cats admitted for hand raising survived. One kitten died 9 days post-admission, due to poor body condition and health leading to secondary infections, and three kittens died 2 mo, 4 mo, and 5 mo post-admission, respectively. The cause of death for two cats was attributed to canine distemper virus (CDV), as ascertained by necropsy findings and a PCR test from brain, lung, and spleen samples. *Pasteurella* spp. were isolated from the lung samples of the fourth animal. The remaining 11 cats that survived were acclimatized and released. On average, the released kittens spent about 178 days (111–309 days) from admission to release. The average weight gain of the kittens was 10.5 (±1.05) g per day during the milk-dependent period and 14.7 (±1.24) g per day after the introduction of solid food (Fig. 2).

Upon release, the cats stayed inside the cage for a while,

even after the doors were left open, and gradually moved out to explore the nearby areas before taking off into the wild. None of the released cats were captured in the camera traps after the initial release implying that the cats did not return to the cage after release. The camera trap photos showed other animals such as mongooses and rodents feeding on the supplementary food inside the cage, but there were no indications of the cats' presence even after 15 days of the camera trap. No other evidence, including footprints, was recorded after release.

### **Challenges and Discussion**

Limited literature is available on the milk composition of leopard cats or specific *Prionailurus* spp., but the literature available on a closely related species from the genus *Felis* indicates that cat milk is low in sugar content relative to fat and protein.<sup>16,17,18</sup> In contrast to cow milk, a commercial kitten milk replacer is highly suggested for leopard cat kittens.

Mortality due to infectious disease is a concern during the nursing period. All the cats were vaccinated during the hand-raising phase for feline infectious diseases but not against CDV (canine distemper virus). Two leopard cats died of CDV. Canine distemper virus primarily affects canids and presents in the form of dysfunction of multiple systems, including the gastrointestinal, respiratory, immune response, and central nervous systems.<sup>19</sup> Many authors have documented clinical disease or seroprevalence of CDV in felids as well. At least in two (*Panthera* and *Lynx*) of the 42 extant felid species, distemper disease and associated mortality have been recorded.<sup>19,20,21,22</sup> Additionally, antibodies towards CDV (seroprevalence) have been detected in those species of wild felids including leopard cats (genus *Prionailurus*).<sup>23,24,25</sup> However, the death of two leopard cats in Assam due to CDV could be the first record of mortality in *Prionailurus* indicating the species' susceptibility to the virus in the wild. Vaccination is an option, but the availability of a feline-specific killed vaccine in the local market is limited. The present condition, using a modified live vaccine (MLV) to protect against feline calicivirus, viral rhinotracheitis, and panleukopenia virus, did not show any adverse reaction after administration. Use of Feligen® CRP vaccine in tigers and lions is also reportedly safe, with the exception of abortion in one lioness, potentially caused by the incorrect use of the feline panleukopenia virus modified live vaccine.<sup>26</sup> However, more elaborate research is needed on its use in the leopard cat. Following the use of an MLV in the kittens, two black-footed cat (*Felis nigripes*) kittens and their dam were found to have an outbreak of herpes and calicivirus.<sup>27</sup> Although unable to definitively prove that the disease observed in these cases was caused by the MLV, temporal and circumstantial evidence suggested that this was the case. Recombinant or killed vaccines could have been the safest choice for use in cats, but they are comparatively rarer in the market.

Successful learning of hunting skills is one of the indicators of fitness for release back to the wild. The success story of the hand-raised orphan cheetah (*Acinonyx jubatus*) was well-documented.<sup>28</sup>

The leopard cats were trained by being introduced to various dead and live prey animals, including poultry, rabbits, and wild prey before release, with minimal human exposure. All the cats in the present study were released in a protected area that already had an unknown population of leopard cats. There is no information available on the number of days or weeks they should be held and the size of the enclosure that should be used. In our case, the period of acclimatization for the leopard cats (7–30 days) might have been too short for the development of site fidelity as evident from the fact that none of the cats returned to the enclosure post-release. Moreover, a large enclosure encompassing the key microhabitat of the leopard cat in the wild for acclimatization would have not only provided ample opportunities for leopard cats to explore and hide, but also permitted holding them for a longer period.

It can be safely assumed that leopard cats survived for the initial few weeks post-release, as the team did not record or receive any report of any mortality of a leopard cat in the vicinity. In the absence of radio transmitters, camera traps were deployed near the enclosure to monitor the cats' presence post-release. The absence of camera trap photos only showed that the cats did not develop any site fidelity despite being kept in the cage at the same location for an average of 20 days. However, site fidelity was noticed in the reintroduced cheetah through a GPS collar in Liwonde National Park, Malawi.<sup>29</sup> It is not often feasible to cover all areas with camera traps, and thus, post-release monitoring with camera traps has its limitations. To record concrete evidence of the survival of such hand-raised felids in the forest, a radio telemetry or satellite approach would be more appropriate.

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