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CONSERVATION APPLICATION

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CONSERVATION APPLICATION

Relocation of a GPS collared conflict Sloth Bear *Melursus ursinus* (Mammalia: Carnivora) in Karnataka, India

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Abstract: The relocation of conflict bears has been a tool used widely across the United States and Canada with mixed results. It has also been used in India with Sloth Bears, though without follow-up it remains unknown how successful these relocation efforts have been. We documented the capture and relocation of a conflict female Sloth Bear from a rural area near Bangalore, Karnataka, India to Bannerghatta National Park roughly 30km away. This female bear, approximately six years old, was fitted with a VHF/GPS store-on-board collar, and her movements tracked. She did not attempt to return to her capture location but during the first two-month period after being released she did roam over an area roughly six times that of typical female Sloth Bear home range. Over the subsequent months the area over which she roamed continued to decline. She was least active mid-day and more active in the evening, night, and early morning. During her last few weeks in January, before she was killed by an explosive device just outside of the park, her movement pattern shrank considerably. The post-mortem examination showed that she had been pregnant when killed and would have given birth within the next two weeks. These reduced movements were consistent with those of periparturient female bears or potentially with a bear becoming more acclimated to her new surroundings. The relocation effort appeared successful up until the Sloth Bear was killed by poacher activity.

Keywords: Activity pattern, denning, Bannerghatta, poaching, crop raiding, reproduction.

Tamil abstract சுருக்கம்: முரண் படுகின்ற கரடிகளை இடமாற்றம் செய்வது அமெரிக்கா மற்றும் கனடா முழுவதும் கலவையான முடிவுகளுடன் பரவலாகப் பயன்படுத்தப்படும் ஒரு கருவியாகும். இடமாற்றம் முறை கரடிகளுக்கு இந்தியாவில் பயன்படுத்தப்பட்டுள்ளது, ஆனால் பின்தொடர்தல் இல்லாமல் இந்த இடமாற்றம் முயற்சிகள் எவ்வளவு வெற்றிகரமாக இருந்தன என்பது தெரியவில்லை. இந்தியாவின் கர்நாடகாவின் பெங்களூருக்கு அருகிலுள்ள ஒரு கிராமப் பகுதியிலிருந்து ஒரு பெண் கரடியைப் பிடித்து சுமார் 30 கி.மீ தொலைவில் இருக்கும் பன்னெர்கட்டா தேசீய பூங்காவுக்கு இடமாற்றம் செய்ததை நாங்கள் ஆவணப்படுத்தினோம். ஏறக்குறைய ஆறு வயதுடைய இந்த பெண் கரடிக்கு வி.எச்.எஃப் / ஜி.பி.எஸ் ஸ்டோர்-ஆன்-போர்டு காலர் பொருத்தப்பட்டிருந்தது, மேலும் அதன் அசைவுகள் கண்காணிக்கப்பட்டன. அந்தக் கரடி கைப்பற்றப்பட்ட இடத்திற்கு மீண்டும் திரும்பி செல்ல முயற்சிக்கவில்லை, ஆனால் விடுவிக்கப்பட்ட முதல் இரண்டு மாத காலப்பகுதியில், வழக்கமான பெண் கரடி வீட்டு வரம்பை விட ஆறு மடங்கு அதிகமாக அது ஒரு பகுதியில் சுற்றித் திரிந்தது. அடுத்தடுத்த மாதங்களில் அது சுற்றித் திரிந்த பகுதி தொடர்ந்து குறைந்து கொண்டே வந்தது. அது மாலை, இரவு, மற்றும் அதிகாலையில் மிகவும் சுறுசுறுப்பாக இருந்தது. நடுப் பகலில் சோர்வாக இருந்தது. ஜனவரி மாதத்தில் அதன் கடைசி சில வாரங்களில், பூங்காவிற்கு வெளியே ஒரு வெடிக்கும் கருவியால் அந்த கரடி கொல்லப்படுவதற்கு முன்பு, அதன் இயக்க முறை கணிசமாக சுருங்கியது. பிரேத பரிசோதனையில் அது கொல்லப்பட்டபோது கர்ப்பமாக இருந்தது, அடுத்த இரண்டு வாரங்களுக்குள் பிரசவித்திருக்கும் என்றும் தெரிய வந்தது. இந்த குறைக்கப்பட்ட இயக்கங்கள், பெண் கரடிகளின் இயக்கங்களுடன் ஒத்துப்போகின்றன அல்லது ஒரு கரடி தனது புதிய சூழலுடன் மிகவும் பழக்கமாகிவிட்டது. இந்த கரடி வேட்டையாடும் நடவடிக்கையால் கொல்லப்படும் வரை இடமாற்றம் முயற்சி வெற்றிகரமாக தோன்றியது.

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INTRODUCTION

Sloth Bears *Melursus ursinus* are among the least studied bear species in the world and therefore one of the least understood (Garshelis & Steinmetz 2015). They are presently listed as Vulnerable on IUCN's Red List (Dharaiya et al. 2016), and as a Schedule 1 species under the Indian Wildlife Protection Act of 1972. The continued deterioration and fragmentation of habitat outside of protected habitats, where it is thought that the majority of Sloth Bears persist, is presently one of the greatest threats to the species (Dharaiya et al. 2016). The recent and complete extirpation of this species from Bangladesh highlights the concern that fragmented Sloth Bear populations are at risk (Islam 2013). Unfortunately, Sloth Bear-human negative interactions are relatively common and often take the form of bear attacks (Rajpurohit & Krausman 2000). For these reasons, it is imperative to explore viable options for handling 'problem' bear situations, other than simply dispatching the 'problem' bear. The relocation of 'problem' bears is one potential option.

The relocation of 'problem' American Black Bears *Ursus americanus* and Grizzly Bears *Ursus arctos horribilis* has been used as a management tool across North America for decades with mixed success (Linnell et al. 1997). Relocation has also been used in India with 'problem' Sloth Bears, though the success or failure of this management tool has not been well documented. A 'problem' bear is generally defined as a bear that has been involved in repeated bear incidents. A 'bear incident' is defined as an occurrence that involves a human-bear conflict or episodes (Skrbinšek & Krofel 2015). A human-Sloth Bear conflict usually means a Sloth Bear attacked a person in a defensive manner or behaved aggressively towards people, though it can also mean the bear was involved in crop raiding. The objective of relocation is to move a 'problem' bear to a new area where they are less likely to become engaged in negative interactions with humans. The relocation of a 'problem' bear is generally considered successful if the bear is not involved in subsequent incidents. Success, however, is often at least partially dependent on whether the bear returns to the capture site. Return rates tend to decrease as the relocation distance increases. Return rates are also lower for juvenile bears rather than adult bears (Rogers 1986; Landriault et al. 2009).

Sloth Bears, while generally not attracted to garbage, have conflicts with humans in the form of crop-raiding and attacks. While crop raiding is not a major problem for this species throughout much of its range, attacks are. Sloth Bears are renowned for their aggressive behavior toward humans (Burton 1856; Anderson 1957; Rajpurohit & Krausman 2000). While a Sloth Bear's attack motivation is exclusively defensive, the attacks can inflict serious injuries to the victim and might result in the victim's death (Rajpurohit & Krausman 2000; Bargali et al. 2005; Sharp et al. 2020). Unfortunately, Sloth Bear attacks are relatively common in India and affect hundreds of people annually (Rajpurohit & Krausman 2000; Bargali et al. 2005; Debata et al. 2016; Garcia et al. 2016; Dhamorikar 2017; Singh et al. 2018; Sharp et al. 2020). Given the large number of attacks that occur annually and the vulnerable status of this species (Dharaiya et al. 2016), it is reasonable to consider different management options for 'problem' bears, including relocation; however, there are no data to suggest how successful these relocations in India have been. Is the mortality rate high? Do relocated Sloth Bears attempt to return to their prior location as Grizzly Bears and American Black Bears sometimes do? In short, is relocation a useful management tool for this species?

A female Sloth Bear, believed to have attacked several people in a village roughly 30km from Bannerghatta National Park, was trapped for relocation. Permission was granted to release the bear back to the wild in Bannerghatta National Park with a GPS (store-on-board)/VHF collar. Given the paucity of data on Sloth Bear relocation efforts, as well as Sloth Bear movement and general ecology, the results of these efforts, though based on a single bear, offer valuable insights. This bear was tracked using the VHF transmitter after being released into Bannerghatta National Park. After six and a half months, she was killed by an explosive device illegally set for Wild Boars *Sus scrofa*. At this point, the collar was retrieved, and the store-on-board data downloaded. A post-mortem of the Sloth Bear showed that she had been pregnant when killed. Based on the morphometry and the weight and developmental size of the two fetuses, the female bear would have likely given birth sometime within the following seven to ten days. Very little is known about Sloth Bear breeding in the wild; therefore, movement patterns were also analyzed with respect to those of a periparturient Sloth Bear.

Study Area

Bannerghatta National Park encompasses roughly 264km^2 of protected habitat (Fig. 1). The terrain is hilly with elevations ranging 1,245–1,634 m. The valleys are predominantly made up of deciduous forest, while the hillsides and higher elevation areas are covered in

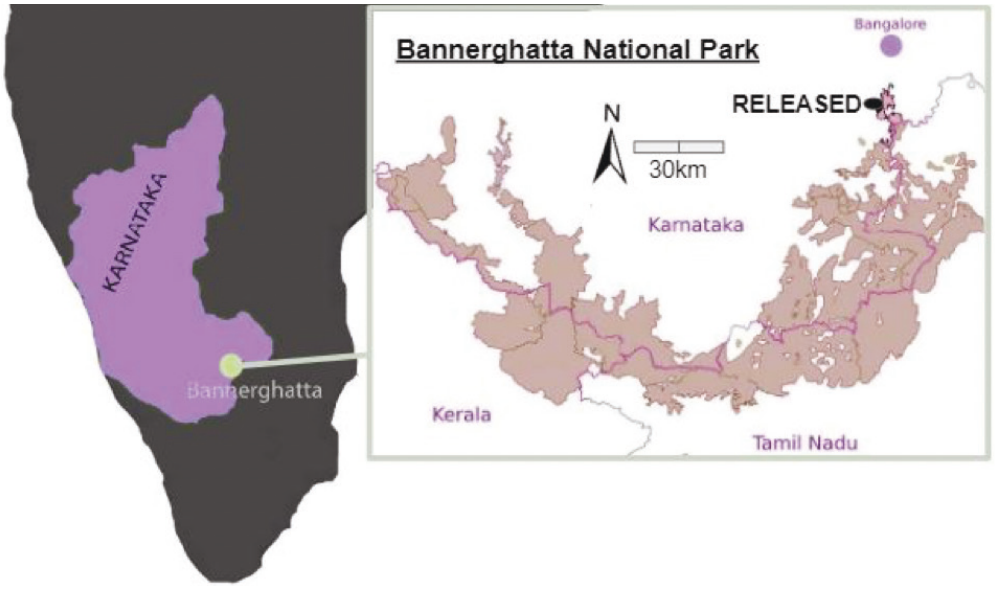

Figure 1. Bannerghatta National Park location within India, and the northeast-most section of the park (inlet map) where the Sloth Bear was released and GPS points were collected.

scrubland. The temperature in the park ranges from an average of 15°C in the winter to an average of 30°C in the summer, and it gets between 625 and 1,607 mm of rainfall annually (Ramachandra & Setturu 2019). The Suvarnamukhi River is the largest perennial river running through the park.

The southern end of Bannerghatta National Park connects to the Talli Reserve Forest and Bilikal Forest. The park also functions as part of an important Asian Elephant *Elephas maximus* corridor which also connects to the Biligirirangana Hills and the Sathyamangalam Forest. The park not only contains Sloth Bears and elephants, but other large mammals including Leopards *Panthera pardus*, Sambar *Rusa unicolor*, and occasionally even Bengal Tigers *Panthera tigris*. Medium and small mammals that live in the park include Dholes *Cuon alpinus*, Golden Jackals *Canis aureus*, Indian Porcupines *Hystrix indica*, and Indian Pangolins *Manis crassicaudata*. Many species of birds and reptiles also occur in the park including Peafowls *Pavo cristatus*, Mugger Crocodiles *Crocodylus palustris*, and Rock Pythons *Python molurus*.

MATERIALS AND METHODS

A young adult female Sloth Bear was trapped at night near a village, roughly 30km from Bannerghatta National Park, on 17 March 2017 using a barrel trap baited with honey and fruit. The bear was taken to a remote enclosure at the Wildlife SOS, Bannerghatta Bear Rescue Centre and was given a general health check, and a blood sample was collected, to make sure she was fit to be released back into the wild. She was kept in isolation from other bears, and human interaction was kept to a bare minimum in order to prevent any habituation behaviors. Permission was eventually granted by local authorities to release her in Bannerghatta National Park. The bear was fitted with a Veltronic Aerospace Vertex store-on-board GPS/VHF collar before being released at 07.20h on 30 June 2017. To get a general idea of her movement, the bear was tracked daily, homing in on the pulsed radio signals from the VHF transmitter in the collar, using a receiver and directional antenna. The tracking sessions were completed in the morning, roughly 75% of the time, and in the evening, roughly 25% of the time. When the bear was found dead, we collected the collar and downloaded the GPS data for further analysis. Additionally, a post mortem was conducted on the bear, primarily to determine the general health of the bear at the time of her demise. When it was discovered that the bear had been pregnant at the time of death, we checked the progesterone levels in her blood from when she was first captured in an effort to determine with certainty whether she had been impregnated before or after she was captured. Sloth Bears have delayed implantation (Puschmann et al. 1977) which make identifying the time of copulation difficult to ascertain simply by knowing the date, or approximate date, of when the cubs were born.

We analyzed the Sloth Bear's movement and frequency of presence by splitting the GPS data points

into three time periods. These categories were chosen based on: limited telemetry data gathered before the GPS data were available, a preliminary assessment of the GPS data to note any obvious change in movement rates, and finally the estimation of when the pregnancy would have become active (when the blastocyst implanted) based on the morphometry and weight of the fetuses during the post-mortem. The first period was made up of the initial two months (30 June through 31 August), when the bear was first acclimating to its new surroundings. The second period was made up of the middle three months (01 September through 30 November), after the bear had some time to acclimate and explore her surroundings. The third period was made up of the last month and a half (01 December 2017 through 17 January 2018), in what we call the periparturient period.

We generated maps representing the Sloth Bear's movement and frequency of presence in a given area using ArcGIS Pro 2.2.1. We recorded coordinates once hourly, with 24 counts per day, and an average daily success rate of 89.7% (~2 missed points, SD: 13.7%), with 33.5% of days having all 24 points recorded and error evenly distributed across the whole sampling period. In total, 4,848 locations were uploaded from the GPS collar, with 4,289 (88.5%) non-blank recordings used for analysis over 202 days. The release period (30 June –31 August 2017) had an 87.9% overall success rate, the acclimation period (September – November 2017) had an 87.5% overall success rate, and the periparturient period (01 December 2017–17 January 2018) had a 91.1% overall success rate. We rendered hotspot representation by using the geoprocessing spatial analyst tool: kernel density, which uses the quadratic kernel function. This method creates a search radius around a point that is classified based on the sum of GPS collar counts within that circular area. Point counts of GPS locations, reported in decimal degrees, were classified into eight bins using the geometric interval method, where warmer colors progressing from red, yellow, to orange, convey high visitation\number of GPS collar counts- and greens convey little to one-time visitation. Each map's high and low densities are respective to the designated period and not standardized across the three time periods.

RESULTS

General Movement Pattern

Once released, the Sloth Bear did not appear to attempt to return to her original capture location. She stayed predominantly within the national park borders, though she did wander outside the park borders (Fig. 2). The area she utilized in six and a half months was 71.2km^2, where 54.6km^2 (77%) were within the park and 16.6km^2 (23%) were outside of the park. The furthest that she roamed beyond park borders was 2.26km to the north. She moved an average distance of 5.9km night, with a minimum of 1.0km and a maximum of 14.7km (Fig. 3). While she did move roughly the same amount from August through December, and even more during the acclimation period than during the release period (Figs. 3, 4, 5), the area over which she moved shrank as time went on. Between 30 June and 30 August, she utilized 63.8km^2 (Fig. 4), between 1 September and 31 November she utilized 31.5 km^2 (Fig. 5) and between 1 December and 17 January, during the periparturient period, she utilized a total area of 23.4km^2. (Fig. 6). In January, the last 17 days before she was killed, she moved an average distance of just over 4km a day, and over a smaller area (8.6km^2) than she had in any of the previous six months (Fig. 7).

Movement was documented south and north of the national park borders, although she eventually settled near the northern border of the park where she spent much of her time. She was photographed multiple times by the use of camera traps and appeared to be a healthy bear (Image 1). She came close to several communities but never, as far as we are aware, had any encounters of consequence with humans. She was found dead just 83m outside of the national park in a fruit orchard (Fig. 7). She had been killed by an explosive device likely set to kill Wild Boars.

24-Hour Activity Pattern

Diel activity patterns show that she was most active 22.30–04.30 h, with minor peaks at 01.00h and 03.30h, and least active 09.00–15.00h (Fig. 8). This activity pattern did not change substantially throughout the six-and-a-half months post-release. In July, when first released, she was most active 17.30–05.30 h, with activity peaks around 00.45h and 05.00h, and least active 08.00–15.30 h. In January, before her death, she was most active 20.00–05.30 h, with activity peaks at 00.00h and 03.45–04.45 h. She was least active 08.00–15.00 h. The slight changes in peak activity and inactivity during the six-and-a-half months post-release

Image 1. Collared Sloth Bear caught in a camera trap.

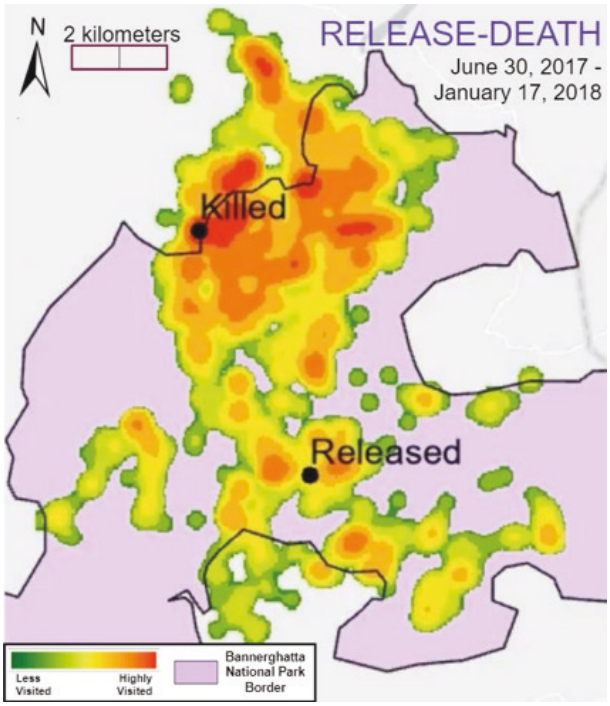

Figure 2. Area utilization by the Sloth Bear over the entire duration of release.
(Days: n= 202, GPS Point Counts: n= 4,289) Hotspot representation rendered by using the geoprocessing spatial analyst tool: kernel density, which uses the quadratic kernel function. Point counts were classified into eight bins (colored) using the geometric interval method.

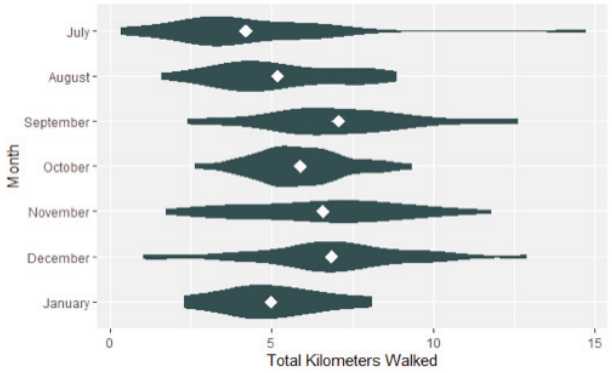

Figure 3. Violin plot of relocated wild Sloth Bear movement per day/ per month (km).
Violin plot demonstrates the range of kilometers traveled daily each month, where thicker regions convey a higher number of days spent walking that respective distance. White diamonds represent the mean value for each month (July: n=31, x̄=4207, SD = 2678; August: n=31, x̄=5198, SD = 1910; September: n=30, x̄=7068, SD = 2345; October: n=31, x̄=5887, SD = 1456; November: n=30, x̄=6576, SD = 2433; December: n=30, x̄=6854, SD = 2471; January: n=17, x̄=4993, SD = 1641).

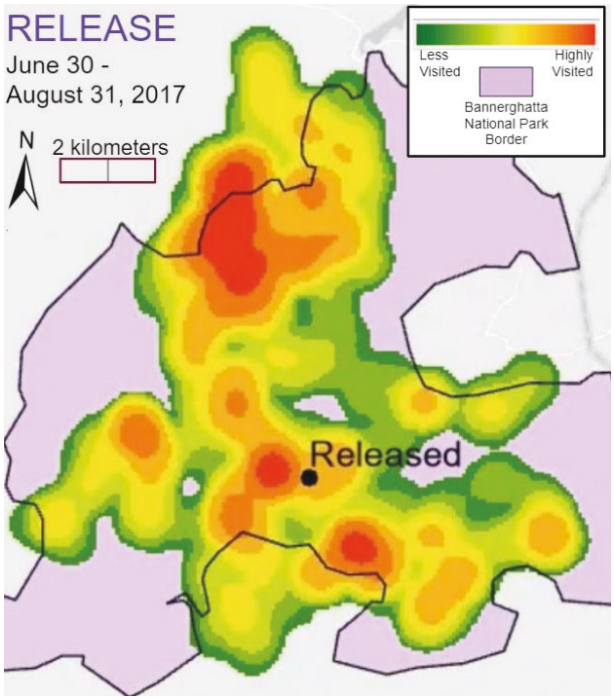

Figure 4. Area utilization by the Sloth Bear during the first two months after release. (Days: n= 63, GPS Point Counts: n= 1,329) Hotspot representation rendered by using the geoprocessing spatial analyst tool: kernel density, which uses the quadratic kernel function. Point counts were classified into eight bins (colored) using the geometric interval method.

are not correlated with slight changes in sunrise and sunset times.

Pregnancy and Denning

Necropsy revealed that the Sloth Bear had been pregnant with two cubs. The fetuses were 14 and 15 cm in length, and weighed 60 and 67 g, respectively. We attempted to discern whether she had been impregnated before or after her release by checking progesterone levels in the blood that had been drawn after capture; however, we were unsuccessful due to: 1) lack of access to a baseline of blood progesterone levels in pregnant Sloth Bears, and 2) the delayed implantation in Sloth Bears may cause a delay in raising progesterone levels,

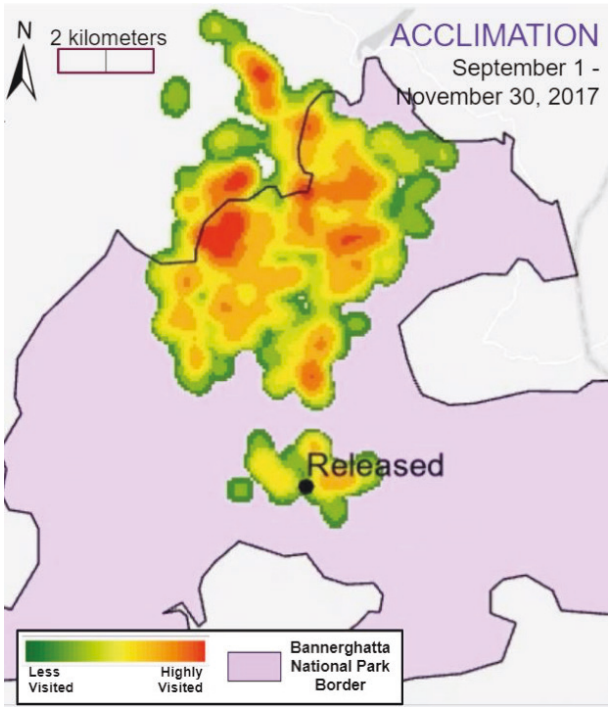

Figure 5. Area utilization by the Sloth Bear during months 3, 4 and 5 in Bannerghatta NP. (Days: n= 91, GPS Point Counts: n= 1,911) Hotspot representation rendered by using the geoprocessing spatial analyst tool: kernel density, which uses the quadratic kernel function. Point counts were classified into eight bins (colored) using the geometric interval method.

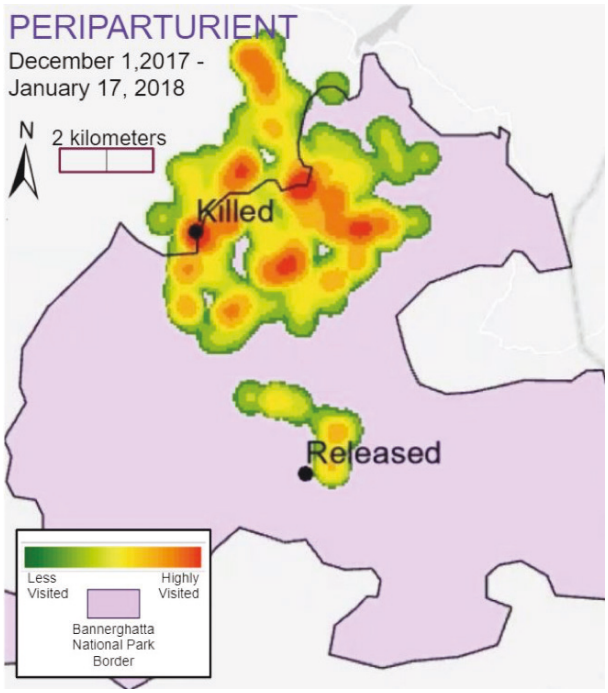

Figure 6. Area utilization by the Sloth Bear during months 6 and 7. (Days: n= 48, GPS Point Counts: n= 1,049) Hotspot representation rendered by using the geoprocessing spatial analyst tool: kernel density, which uses the quadratic kernel function. Point counts were classified into eight bins (colored) using the geometric interval method.

as seen in other bear species (Foresman & Daniel 1983).

By reviewing the data from the store-on-board GPS unit, we were able to locate multiple resting dens that she had used, including the den she had been using in January. It is likely that this latter den would have been used as the maternal den, which we describe further in the discussion. This den is located in the national park, just 60m from the boundary (Fig. 7).

DISCUSSION

General Movement Patterns

The bear did not appear to attempt to travel back to her capture site though she was only moved 30km. Translocating an American Black Bear or Grizzly Bear only 30km from the trap site would carry with it a relatively high probability that the bear would attempt to return to the trap site (Rogers 1986; Linnel et al. 1997). Sloth Bears, however, have relatively small home ranges compared to these two species and this may affect how far Sloth Bears need to be moved to reduce the likelihood they will return to their capture site area. This Sloth Bear did range over a large area inside and outside of the park borders. Given that the home range for female Sloth Bears in Nepal's Royal Chitwan National Park was estimated at 9.4km^2 (Joshi et al. 1995) and 12.4km^2 in Panna National Park (Yoganand et al. 2005), she appeared to have spent the first two months exploring her new surroundings by utilizing an area roughly six times the size of a typical home range. Interestingly, translocated Grizzly Bears in Alberta, Canada translocated outside of their bear management area of capture, were shown to initially have home ranges roughly 3.25 times that of other resident bears (Milligan et al. 2018). While the presence of other Sloth Bears may be an influencing factor in the dispersal of this individual, the population within Bannerghatta National Park is unknown. It has been speculated that this increase in movement could be linked to increased energetic costs of the bear during the relocation acclimation period (Milligan et al. 2018).

During the Sloth Bear's second three-month period, her activity only utilized an area roughly three times the size of a typical female Sloth Bear's home range, and in December an area only roughly twice the size of a typical home range. This eventual reduction in home range size is consistent with the translocated Grizzly Bears in Alberta, Canada which also saw an overall reduction in home range size as time went on (Milligan 2018). However, the reduction in the size of the Sloth Bear's home range occurred at a much faster rate than it did

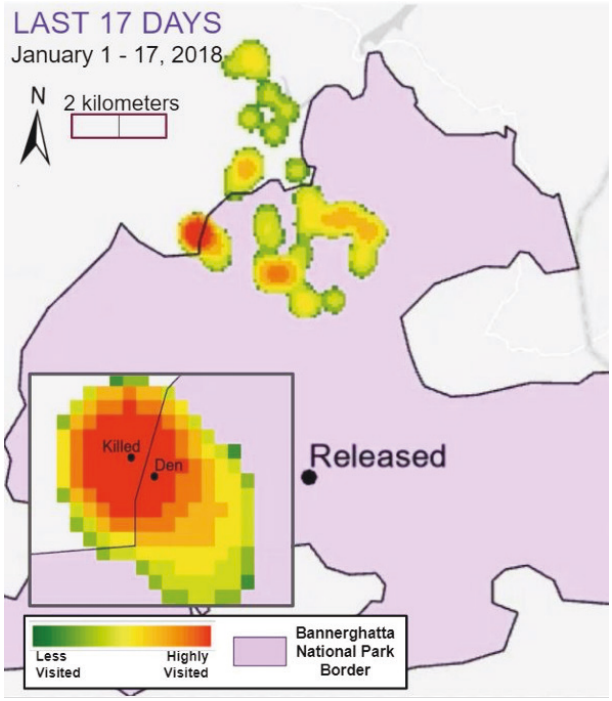

Figure 7. Area utilization by the Sloth Bear for two weeks before death in month 7. (Days: n= 17, GPS Point Counts: n= 372) Hotspot representation rendered by using the geoprocessing spatial analyst tool: kernel density, which uses the quadratic kernel function. Point counts were classified into eight bins (colored) using the geometric interval method.

for the grizzlies in Alberta. The Sloth Bear's movements in January covered an area more comparable to the estimated home range size for an adult female Sloth Bear; however, this reduction may have been more related to the fact that she was preparing to give birth, rather than a sign she had acclimated to her new surroundings.

24-Hour Activity Pattern

Sloth Bears, though occasionally diurnal, are known to be predominantly crepuscular and nocturnal (Joshi et al. 1999; Chauhan et al. 2004; Yoganand et al. 2005; Ramesh et al. 2013). Subadults and females with cubs, however, may be more active in the morning hours, which may be an attempt to avoid large male Sloth Bears or predators (Joshi et al. 1999). Given that this bear was an adult female without cubs, her activity pattern is consistent with solitary adult females from other studies.

There is a longer period of complete inactivity in November, December, and January; however, we cannot be certain whether this is related to the bear's pregnancy, the bear's acclimation to her new surroundings or an unknown variable.

Pregnancy and Denning

Sloth Bear mating generally occurs during April, May, June, and possibly July in this part of the country (Arun et al. 2018a) and cubs are born five to eight months later (Stirling 1993). This bear was captured on 17 March and therefore likely impregnated after her release. Additionally, in early July, while tracking her with VHF technology, it was noted by observing her footprints that she was in the company of a second sloth bear, which could have possibly been her mate. Though generally solitary, Sloth Bears do have a high degree of mutual tolerance for one another (Joshi et al 1999). Therefore, although we cannot be certain when she was impregnated, we believe it to be most likely that she was impregnated after her release back to the wild.

It is not surprising that the mating window in this part of India may be a little wider than previously thought as the Sloth Bear mating season varies slightly by location. In Nepal, they are known to breed May through July (Joshi et al. 1999), and in Sri Lanka, they are thought to breed year-round. If indeed, she had been impregnated post-release, it suggests low-stress levels and adjustment to her new surroundings. Whether impregnated before or after release is perhaps less important than the fact the pregnancy was moving forward. The delayed implantation capabilities of the Sloth Bear allow a female to abort and absorb the pregnancy if the animal is physically or environmentally stressed (Mead 1989; Given & Enders 1989). Therefore, the fact that the pregnancy was moving forward suggests that the sloth bear was not overly stressed in her new environment, or at least that the increased energetic costs likely associated with the relocation were still low enough for her to reproduce successfully.

Once implanted, the fetus grows to completion in roughly two months, as is the average time of gestation in bear fetuses (Tsubota et al. 1987; Quest 2001). Since we estimate she was going to give birth in late January or early February, it seems likely that her pregnancy influenced her movement patterns in December and January. It is also possible that her movements were further reduced in January due to her having identified a maternal den and associated reduction in feeding. Though Sloth Bears in captivity are known to eat within 24 hours of parturition, periparturient appetite is suppressed as parturition approaches (Arun et al. 2018a).

After the bear's death, we inspected the area where she had spent a large amount of her time in January to search for dens. We located several dens, including one within the hotspot. We believe this was likely the den

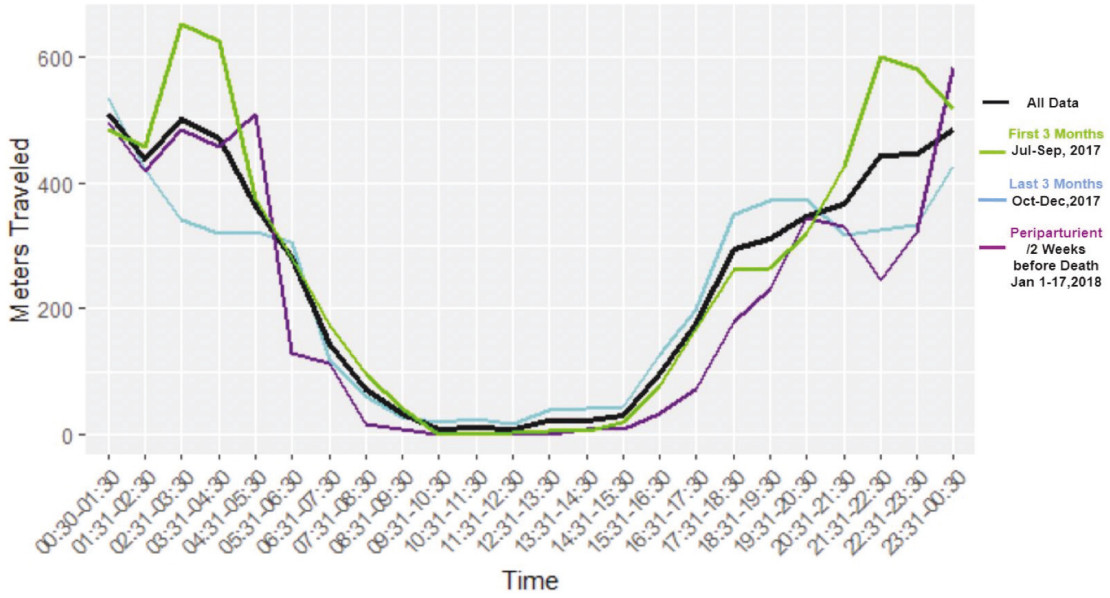

Figure 8. Sloth Bear 24-hour activity pattern per hour. Mean movement (in meters) during 1-hour time blocks for each respective time period, where black is a mean of all data (N=202), green is the mean of the first three months after release (30 June–30 September 2017, n= 93), blue is the mean of the following three months after release (1 October–31 December 2017, n= 92), and purple is the last ~2 weeks before death, during the periparturient time period where implantation is expected to have occurred (1–17 January 2018, n= 17).

in which she planned to give birth to and raise her cubs since the location was the center of her activity as she approached parturition. This den is located only 60m from the border of the national park. Because this bear spent a significant amount of time just outside the national park in an area with fruit trees, it suggests she might have intentionally chosen to den in the wilderness with food resources, in this case, a fruit orchard, nearby.

This Sloth Bear was killed near the Bannerghatta National Park border by an explosive device set by poachers most likely to hunt Wild Boars. These devices are hidden in food and detonate when bitten, thus presenting a risk to non-target species (Arun et al. 2018b). Consequently, these devices potentially pose a particular threat to wildlife, which range just outside of protected areas to forage in agricultural areas.

RELOCATION CONCLUSIONS

As stated previously, the relocation of a nuisance bear is generally considered successful if the bear is not involved in any subsequent human-bear conflicts. This is often at least partially dependent on whether the bear returns to their capture site. We believe this Sloth Bear's relocation was successful because: 1) she did not attempt to return to her capture site, 2) she was not involved in human-bear conflicts, other than occasional crop-raiding, 3) she adjusted to her new surroundings and began to establish a home range, 4) she was likely impregnated post-release, 5) her pregnancy was moving forward and we believe she established a maternal den, and 6) she was a healthy bear, based on camera trap photos of her as well as her necropsy.

Given these findings, this relocation effort was deemed a success until the bear was killed. It is also important to note that her death was not the result of a "direct" conflict situation but rather due to a negligent and illegal act not focused on sloth bears. Clearly, this is only one bear, and more documentation is needed in the future in order to determine how successful relocation efforts of Sloth Bears are; however, based on this case study, there is reason to be optimistic.

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Author contribution: Attur Shanmugam Arun—1) project leader, 2) project coordination, 3) lead on capturing and collaring sloth bear, and 4) writing and analysis. Shanmugavelu Swaminathan—1) lead field biologist, 2) capturing and collaring bear, 3) tracking bear, and 4) writing and analysis. Yogaraj Pannerselvam —1) capturing and collaring Bear 2) Tracked the bear the majority of the time, 2) Valuable Insight into bear activities. Thomas Robert Sharp—1) lead on writing and analysis, 2) background research on bear relocation of other bears species and 3) arrangement of manuscript to JoTT. Sydney Stephens—1) analysis and 2) mapping. Kartick Satyanarayan—oversight of the project and important insights into the results. Geeta Seshamani—oversight of the project and important insights into the results.

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