LIVING WITH LEOPARDS: UNDERSTANDING THE MUMBAI LEOPARDS AND THEIR INTERACTIONS WITH PEOPLE

A report of the research project conducted in collaboration with Maharashtra Forest Department and supported by WeWork India Management Limited

2023-2025

WCS-India

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PREFACE

Wildlife Conservation Society–India (hereafter WCS-I) has been studying leopards in Mumbai to deepen our understanding of human-wildlife interactions within the urban metropolis. The "Living with Leopards" project builds on this research, aiming to foster coexistence through scientific findings that guide awareness campaigns, outreach initiatives, and management recommendations. This project by WCS-I is supported by WeWork India Management Limited (hereafter WeWork), promoting efforts for nature conservation.

WCS-I is pleased to present the final report for the project as per the requirements of the grant received from WeWork. This report summarises all the activities undertaken as part of the MoU between WCS-I & WeWork from 2023-2025.

During this period, major activities included population estimation of leopards in Mumbai's urban landscape, conducting awareness sessions, rescues and monitoring of leopard sighting reports, and engaging with various sections of the public to foster appreciation for urban wildlife.

This report outlines the progress made during the reporting period, showcasing key achievements and the impact of various initiatives. WCS-I extends its gratitude to WeWork for their generous support, which has enabled significant advancements in wildlife conservation and community engagement efforts in this urban landscape.

REPORT SUMMARY

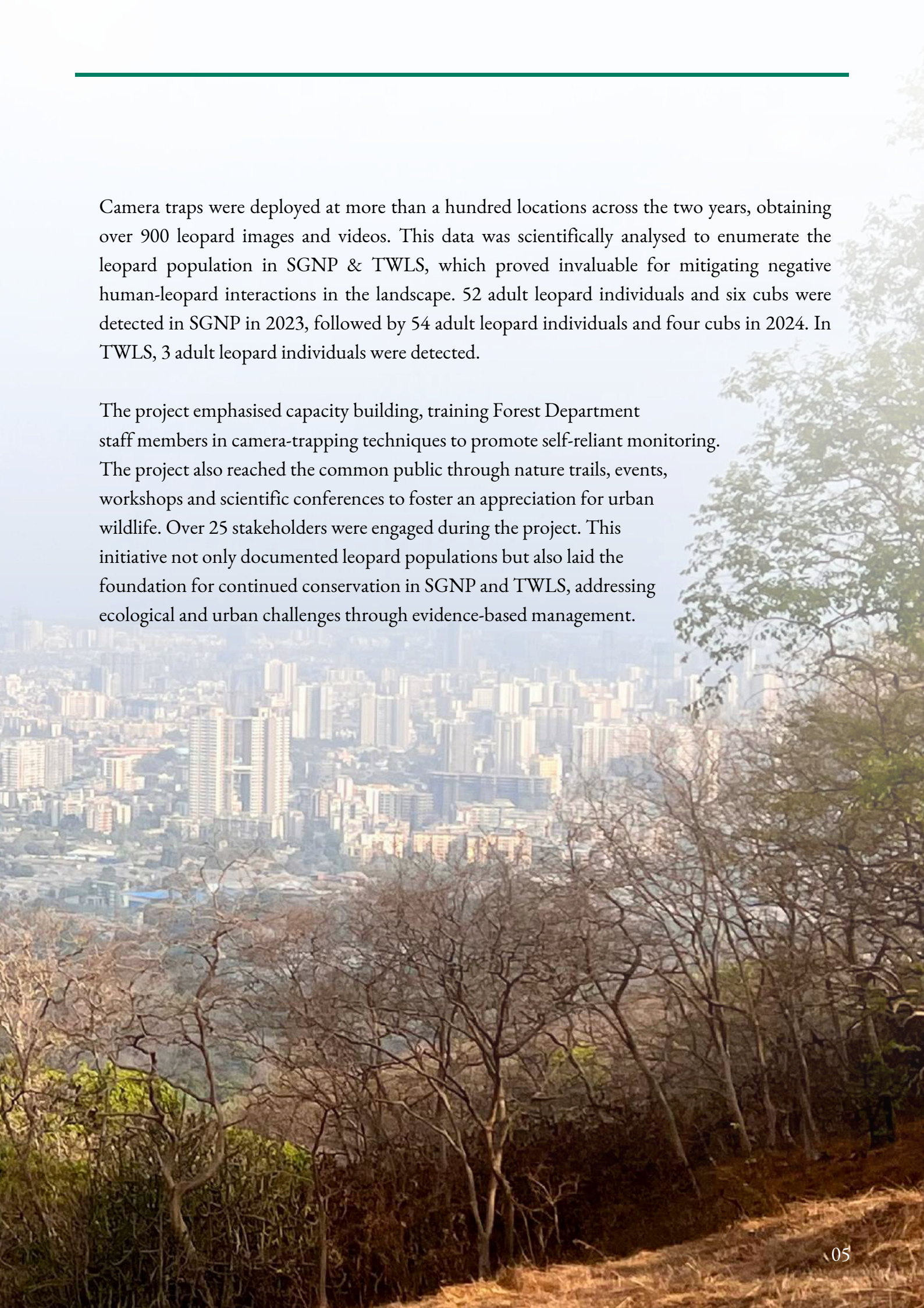
Wildlife is increasingly being observed thriving in human-dominated landscapes worldwide. Sanjay Gandhi National Park (hereafter SGNP) in Mumbai represents a globally unique example of a large carnivore, the Indian leopard (*Panthera pardus fusca*), thriving in high densities within a densely populated urban landscape. The neighbouring Tungareshwar Wildlife Sanctuary (hereafter TWLS), surrounded by suburbs, serves as a critical connecting forest area for leopards. Effective management strategies have significantly minimised negative human-leopard interactions, underscoring the importance of continuous monitoring to sustain these successes. This project seeks to study leopard population dynamics, build capacity within the Forest Department for independent research, and ensure long-term conservation through a self-sustaining framework.

We carried out leopard population assessments in SGNP in 2023, followed by both SGNP and TWLS in 2024 using camera traps in a capture-recapture framework. Reconnaissance foot surveys identified optimal locations for camera deployment, ensuring comprehensive area coverage.

[Photo credits: Karan Sikka/WCS-India]

Camera traps were deployed at more than a hundred locations across the two years, obtaining over 900 leopard images and videos. This data was scientifically analysed to enumerate the leopard population in SGNP & TWLS, which proved invaluable for mitigating negative human-leopard interactions in the landscape. 52 adult leopard individuals and six cubs were detected in SGNP in 2023, followed by 54 adult leopard individuals and four cubs in 2024. In TWLS, 3 adult leopard individuals were detected.

The project emphasised capacity building, training Forest Department staff members in camera-trapping techniques to promote self-reliant monitoring. The project also reached the common public through nature trails, events, workshops and scientific conferences to foster an appreciation for urban wildlife. Over 25 stakeholders were engaged during the project. This initiative not only documented leopard populations but also laid the foundation for continued conservation in SGNP and TWLS, addressing ecological and urban challenges through evidence-based management.



IMPACT SUMMARY

47000+
images and videos analysed

900+
leopard photo-captures

2800
nights of camera trapping effort (trap nights)

140+
camera trap stations

Leopard individual identified:

52 adults & 6 cubs
2023

57 adults & 4 cubs
2024

IMPACT SUMMARY

3
leopard rescue operations

750+
kilometers walked

6000+
total audience reached

25+
stakeholder groups engaged

INTRODUCTION

The Indian leopard (*Panthera pardus fusca*) is one of the most widespread members of the large felid group in India (Jacobson et al., 2016). Its generalist resource requirements and high behavioural adaptability enable it to thrive in a vast range of habitat types, including human-modified landscapes (Athreya et al., 2013; Odden et al., 2014). Despite its adaptations, the Indian leopard faces significant conservation challenges due to habitat fragmentation and negative human-wildlife interactions.

Although Indian leopard populations are increasing in several forested regions, only 11% of their extant range lies within protected areas (Jacobson et al., 2016). Increasingly, evidence shows wildlife, including leopards, inhabiting human-dominated landscapes outside these areas (Athreya et al., 2013; Kshettry et al., 2017).

In human dominated landscapes, leopards often rely on livestock for sustenance, while in semi-urban and urban regions, they adapt their diet to include free ranging dogs and cats (Kumbhojkar et al., 2021; Surve et al., 2022). These resource subsidies outside protected areas enable leopards to persist in high densities (Majumder et al., 2024; Surve et al., 2022). Their smaller body size, resilience, and adaptability allow them to coexist near humans successfully (Athreya et al., 2004).

Population estimation is key to reducing negative human-leopard interactions and guiding conservation efforts. By mapping leopard density and distribution, managers can pinpoint on hotspots where interactions are maximum and focus on solutions like community outreach and better livestock protection.

Sanjay Gandhi National Park (SGNP) in Mumbai offers a unique example of leopards thriving in a dense urban landscape with minimal negative interactions, as a result of effective management (Surve et al., 2022). This project continues monitoring efforts in SGNP while building the Forest Department's capacity to carry out independent monitoring and sustain long-term conservation outcomes.

STUDY AREA

Mumbai is unique among the world's megacities for supporting a thriving population of wild leopards within its city limits. Sanjay Gandhi National Park and its adjoining green spaces, including Aarey Milk Colony and the Tungareshwar Wildlife Sanctuary, provide critical habitat for these leopards.

The leopards of Mumbai have demonstrated extraordinary adaptability, persisting alongside one of the densest human populations. They play an important ecological role as apex predators, helping to maintain the balance of prey populations and contributing to the overall health of Mumbai's urban ecosystem. However, their proximity to human settlements also brings challenges related to negative human-leopard interactions.

Fig 1: Image depicting the sharp boundary of SGNP within the city of Mumbai. Credits: Veerendra Naidu/ WCS-India

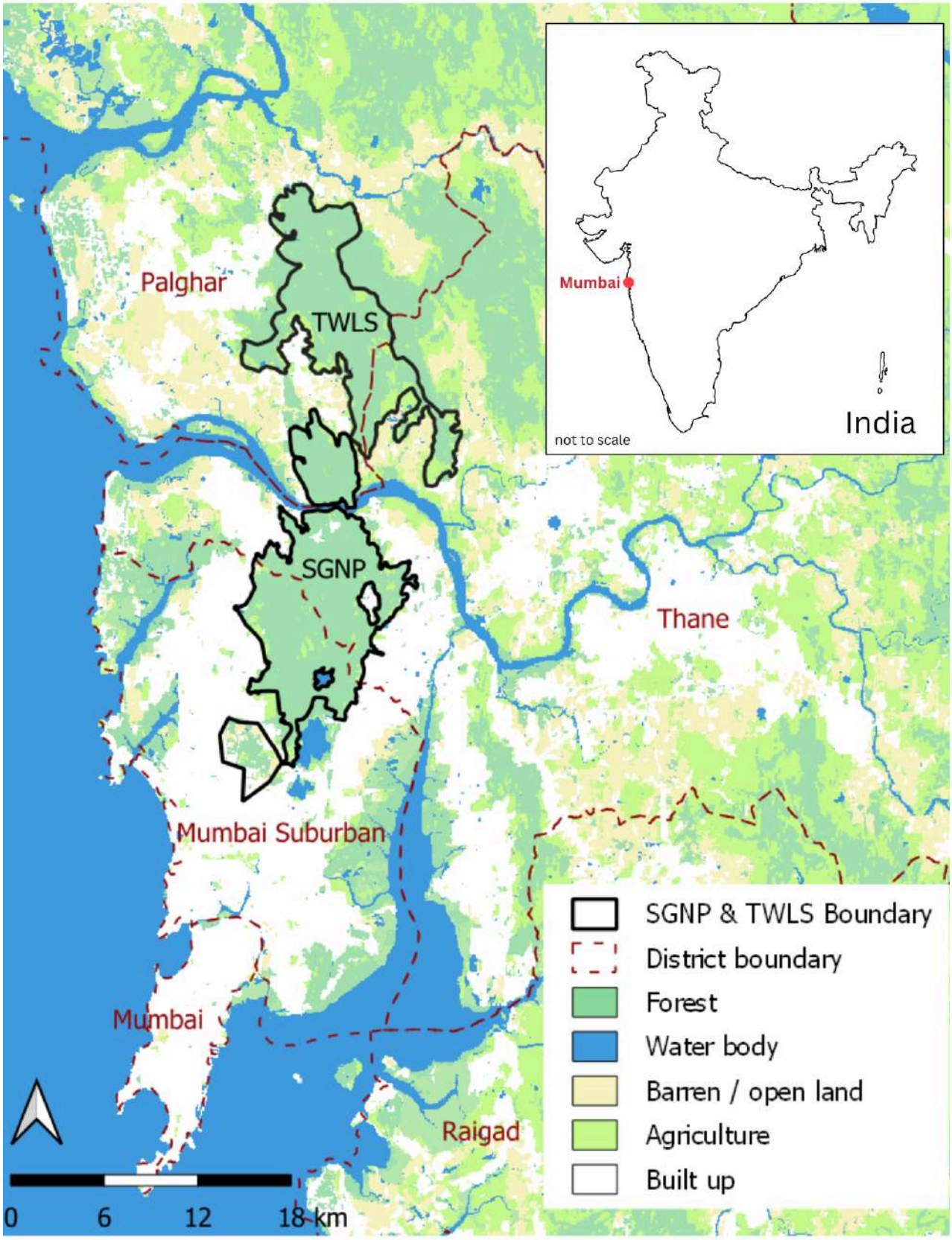


Fig 2: SGNP & TWLS, situated in a densely human landscape.

Sanjay Gandhi National Park (SGNP):

SGNP is situated in the middle of two metropolises of Mumbai and Thane (19° 8′ N, 72° 53′ E and 19° 21′ N, 72° 58′ E). It is surrounded by dense human areas on three sides except for the north, where SGNP continues into TWLS (Figure 3).

Elevation ranges from 30 to 500 m above mean sea level, and the vegetation is categorised as the southern moist deciduous type (Champion & Seth, 1968).

SGNP hosts one of the highest reported leopard densities globally, estimated to be 26.34 ± 4.96 leopards / 100 sq km, living alongside a very high density of humans (20,000 people/ sq km) (Surve et al., 2022).

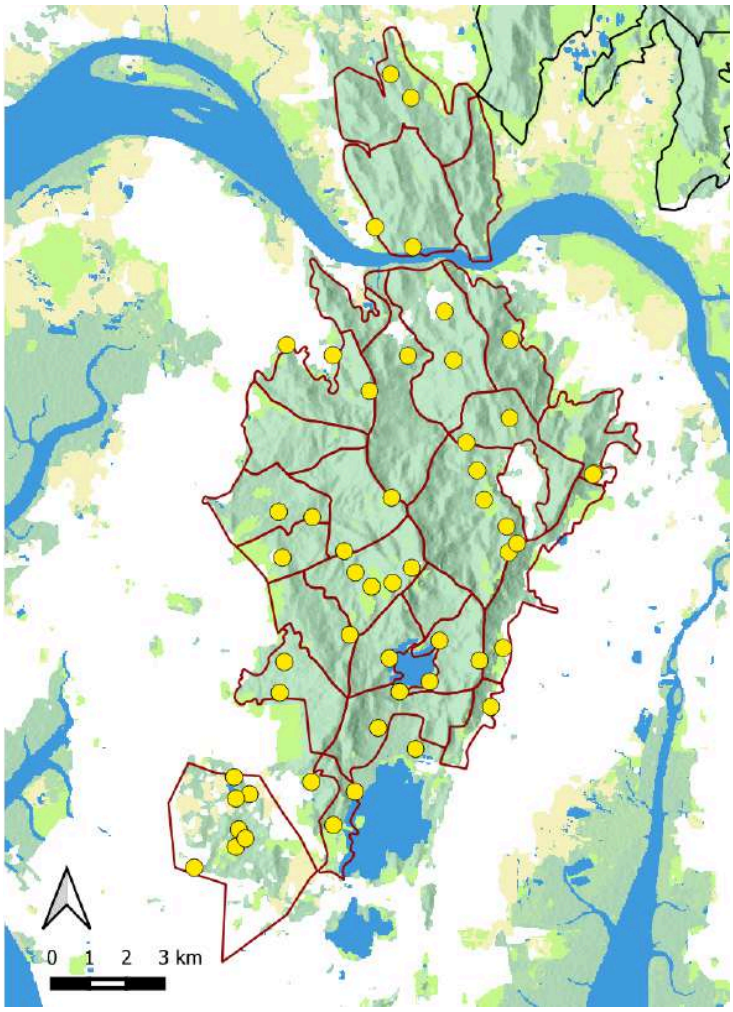


Fig 3: Map depicting camera trap locations (yellow points) in SGNP.

Other carnivores found in this landscape are the jungle cat (*Felis chaus*), rusty-spotted cat (*Prionailurus rubiginosus*), common palm civet (*Paradoxurus hermaphroditus*), small Indian civet (*Viverricula indica*), gray mongoose (*Herpestes edwardsii*) and the ruddy mongoose (*Herpestes smithii*). Herbivores that occur here include chital (*Axis axis*), sambar (*Rusa unicolor*), southern plains langur (*Semnopithecus entellus*), wild pig (*Sus scrofa*), bonnet macaque (*Macaca radiata*), rhesus macaque (*Macaca mullata*), barking deer (*Muntiacus muntjak*), Indian chevrotain (*Moschiola indica*), black-naped hare (*Lepus nigricollis nigricollis*), and Indian crested porcupine (*Hystrix indica*).

Additionally, the park is also home to the *Warlis*, an indigenous tribe, residing within SGNP who have learned to co-exist with wildlife. SGNP provides crucial ecosystem services to the city of Mumbai, while being one of the most visited PAs in the country.

Tungareshwar Wildlife Sanctuary:

TWLS is situated north of SGNP (19.301°N - 19.475° N and 72.852°E - 73.002°E). It is narrowly connected with SGNP along its southern edge. The terrain is hilly and undulating, with large rock patches. Mammals that are reported from TWLS include leopard, jungle cat, rusty-spotted cat, wild pig, common palm civet, small Indian civet, southern plains langur, bonnet macaques, grey mongoose, black-naped hare, Indian chevrotain, and barking deer.

Ancient religious structures such as Tungareshwar Mahadev Temple, Parshuram Kund and Ishwarpuri Mahadev Mandir situated within the protected area are frequented by tourists.

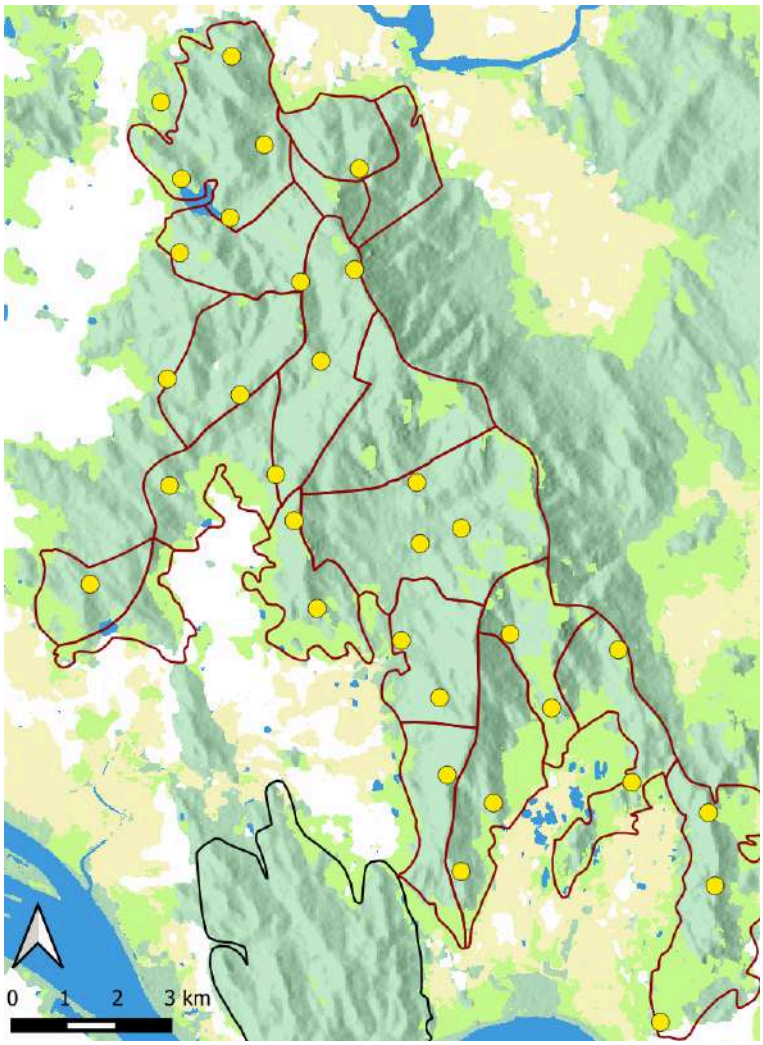


Fig 4: Map depicting camera trap locations (yellow points) in TWLS.

Rapid urbanisation around the sanctuary is observed, with residential apartments, industrial blocks, and linear infrastructure being developed. A National Highway (NH-48) cuts through TWLS, while other roads (Shirsad-Bhiwandi Road, Bapane-Jhuchandra Road) encircle the sanctuary. A state highway (Chinchoti-Bhiwandi road) and a railway line fragment the connectivity between SGNP and TWLS.

MONITORING THE LEOPARD POPULATION IN SGNP & TWLS

The population of leopards was estimated twice in SGNP and once in TWLS during the project period. Extensive reconnaissance surveys across the study area were conducted with Forest Department staff to find suitable camera trap locations. Pugdundees and natural trails within the study area were surveyed for leopard signs, like scats, scrape marks, pugmarks, or scratch marks, with a reconnaissance walk effort of 100+ kilometres. Suitable locations were marked using a handheld GPS device. Camera trap locations were systematically chosen to maximise the probability of photographing leopards and ensure coverage of the entire study area (Figure 3 & 4).

For logistical convenience, the camera trapping exercise was divided into two blocks. At each location, two camera traps were positioned on either side of a trail, at about 40-45 centimetres height from the ground to capture both flanks of a leopard (Figure 5). At locations with high human presence, the camera traps were deployed in the evening and retrieved in the morning to avoid the risk of theft.

Fig 5: Camera traps were deployed at suitable locations, while the Forest Department staff were trained on the field. Credits: Nikit Surve/ WCS-India

Leopard photographs were screened out from the camera-trap data. The unique rosette patterns on each leopard's flanks were used for individual identification (Figure 6). Each confirmed individual was assigned a unique alpha-numeric identity to enumerate the minimum number of leopard individuals detected in the study.

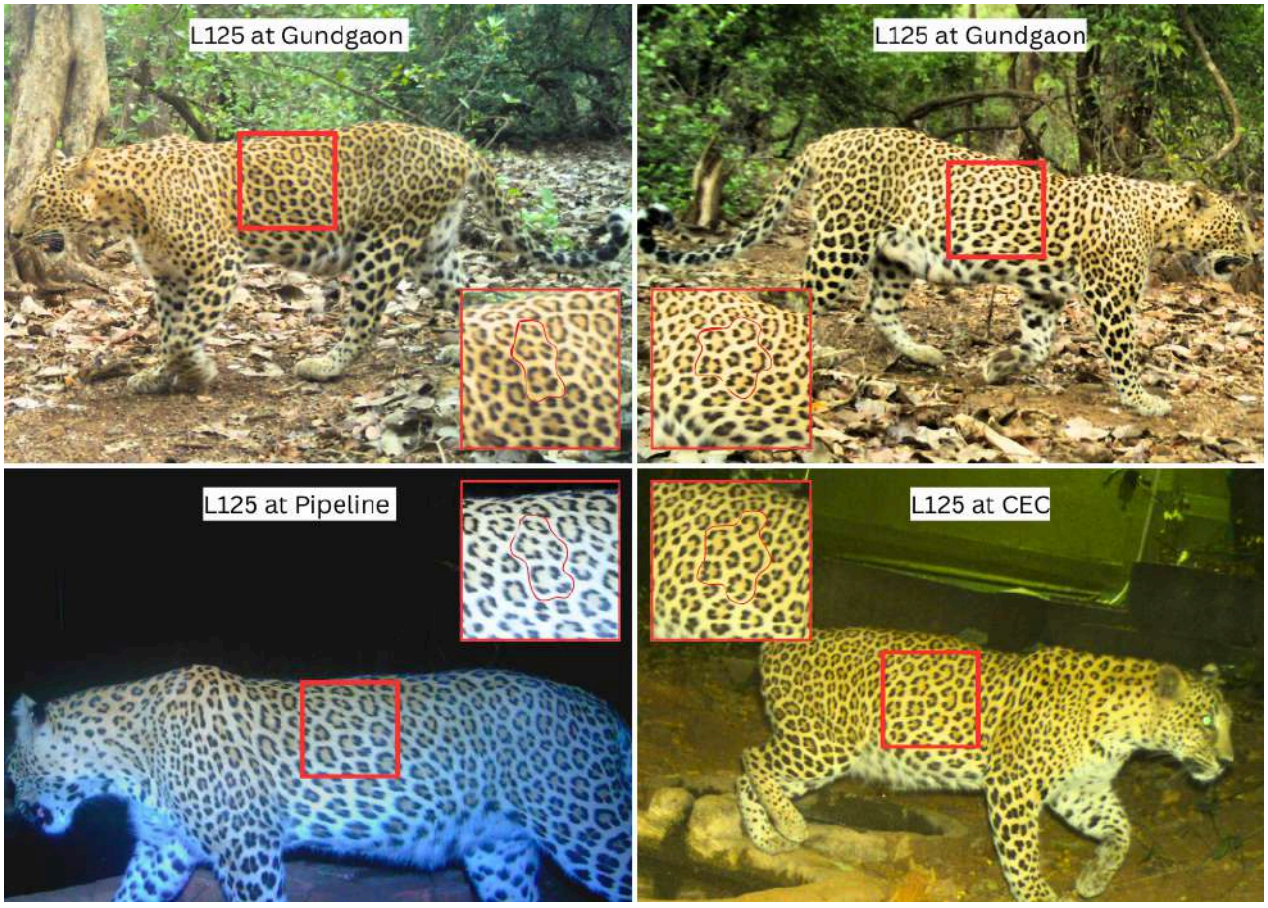


Fig 6: Identifying leopard individuals photo-captured at different locations using unique rosette patterns.
Credits: Veerendra Naidu/ WCS-India/ Maharashtra Forest Department

Research Outcomes

		Block	Range	Total Camera trap locations	Start date	End date	Trap nights per location
SGNP	**2023** (20th April 2023 to 15th June 2023)	Block I	Tulsi & KUB range	20	20th April 2023	16th May 2023	26
		Block II	Yeur Range, and Aarey milk colony.	29	12th May 2023	15th June 2023	35
	2024 (22nd April 2024 to 7th June 2024)	Block I	KUB, Tulsi & Aarey Milk colony	32	22nd April,2024	13th May 2024	21
		Block II	Yeur range	25	16th May 2024	7th June 2024	22
TWLS (January to March 2024)		Block I	North Tungareshwar	18	15th February 2024	7th March 2024	21
		Block II	South Tungareshwar	15	13th March 2024	5th April 2024	21

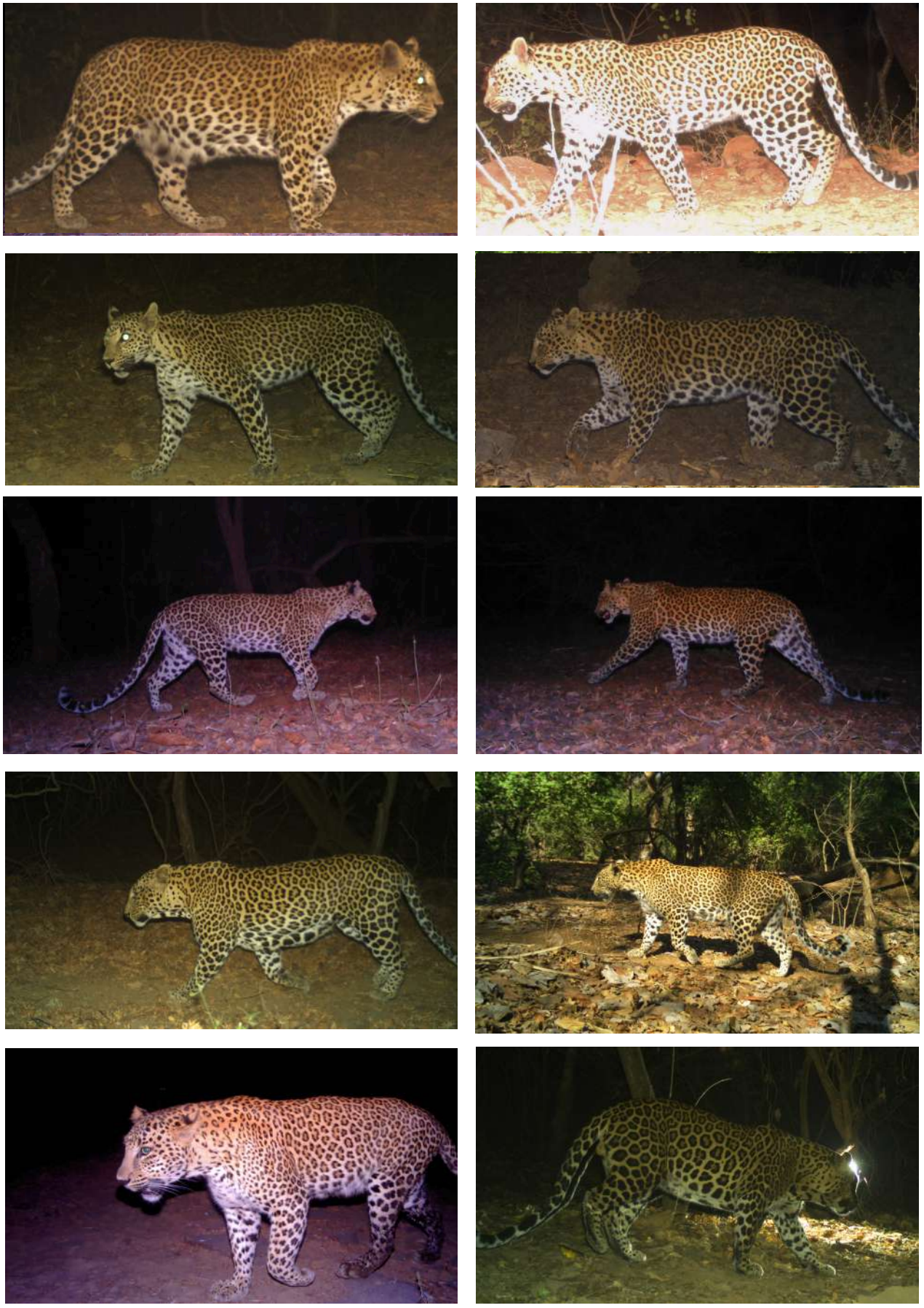


Fig 7: Leopard images from SGNP & TWLS. Credits: Maharashtra Forest Department/ WCS-India

Interesting observations

Mating pairs:

Although leopards are solitary animals, male and female individuals can be observed moving around together during their mating period. Such a mating pair was also photo-captured in our camera traps.

Fig 8: Mating pair observed in SGNP during the camera trapping.
Credits: Maharashtra Forest Department/ WCS-India

Predation on domestic animals:

In human-dominated landscapes like Mumbai, domestic animals form a major prey resource for leopards. A leopard preying on a domestic cat was documented in our camera traps.

Fig 9: A leopard with a domestic cat kill. Credits: Maharashtra Forest Department/ WCS-India

Leopard cubs

Detecting leopard cubs on camera traps is a rare and significant event, offering valuable insight into breeding success and population stability in the landscape. Cubs are highly vulnerable and usually remain hidden, making their documentation through non-invasive methods like camera trapping both novel and informative. Such detections not only indicate the presence of a breeding population but also highlight the suitability of the habitat for rearing young. These sightings strengthen the case for continued conservation and monitoring efforts.

Fig 10: Leopard cubs photographed with their respective mothers in SGNP.
Credits: Maharashtra Forest Department/ WCS-India

Leopard with Karvi: A shrub that blooms once every eight years

Once every eight years, the rare Karvi shrub (*Strobilanthes callosa*) blooms for 15-20 days, and these ephemeral purple flowers cover the forest of SGNP. Our camera trap photo-captured a leopard with the purple background of Karvi flowers. This rare image not only captured a piece of nature's artwork but also symbolised the delicate balance of life thriving in Mumbai's forested heart.

Fig 11: A leopard photo-captured with the background of Karvi (*Strobilanthes callosa*) flowers, which bloom once every 8 years. Credits: Maharashtra Forest Department/ WCS-India

Leopard persistence in SGNP

Three female leopards first photographed in SGNP in 2015 were photographed again in 2024, confirming persistence for over nine years. The continued presence of individual leopards over a nine-year period underscores the long-term viability of the habitat and the species' ability to coexist in a human-influenced landscape. It also reflects the importance of sustained conservation efforts and regular monitoring in supporting stable carnivore populations.

2024 **2015**

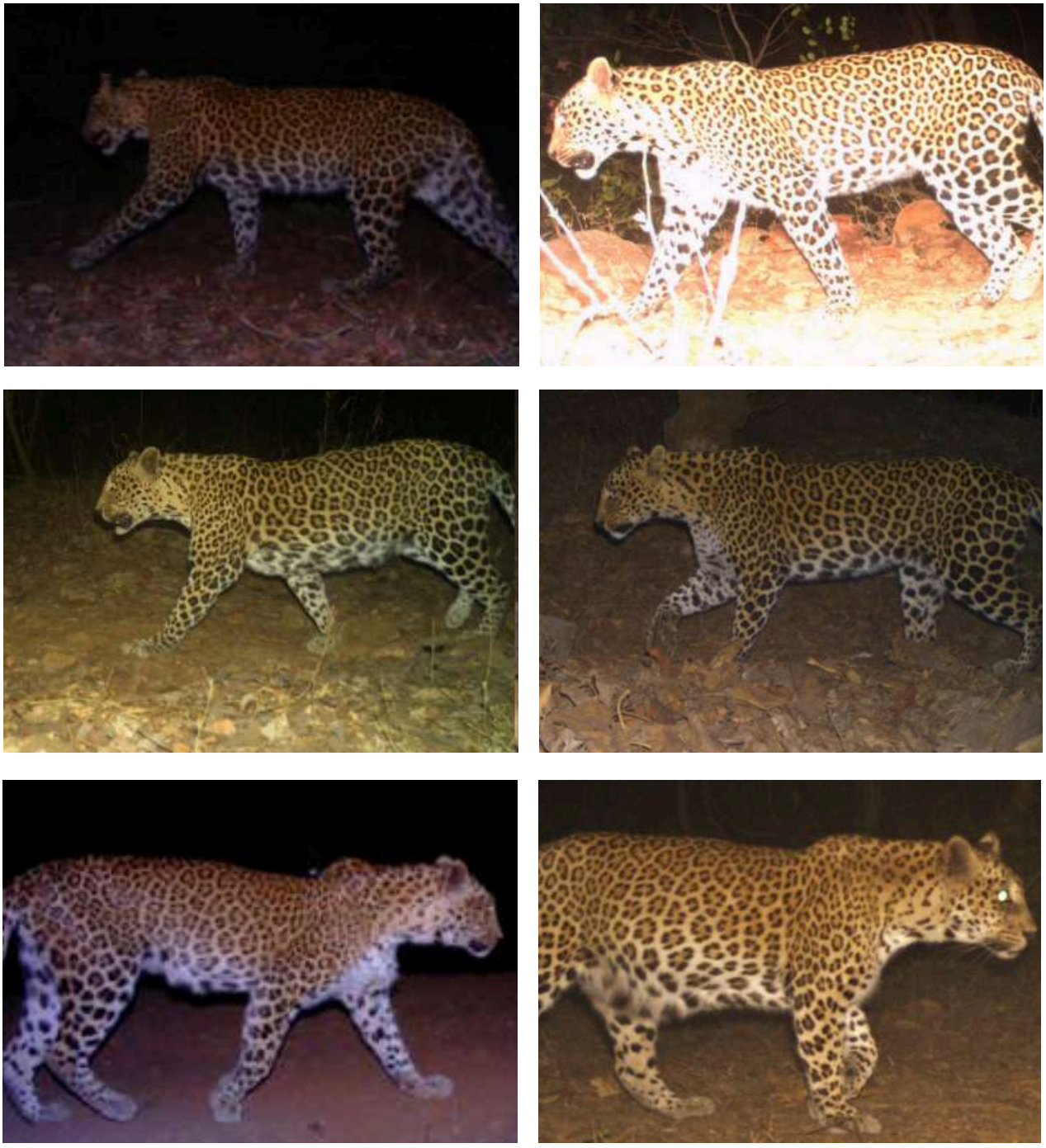


Fig 12: Leopard individuals persisting in SGNP since 2015. Left: Photo capture from 2024; Right: Photo capture from 2015. Credits: Maharashtra Forest Department/ WCS-India

Mammalian diversity photo-captured

In addition to leopards, camera traps documented a wide range of mammalian species, highlighting the biodiversity supported by SGNP & TWLS, amidst human-dominated surroundings. The following species were photo-captured during the study


Bonnet macaque *(Macaca radiata)*


Southern plains langur *(Semnopithecus entellus)*


Indian chevrotain *(Moschiola indica)*


Barking deer *(Muntiacus muntjak)*


Chital *(Axis axis)*


Sambar *(Rusa unicolor)*

Fig 13: Mammalian species photographed in SGNP & TWLS in 2024.
Credits: Maharashtra Forest Department/ WCS-India

MONITORING LEOPARD SIGHTINGS ON THE PERIPHERY OF SGNP-TWLS

Situations involving leopard sightings in the human-dominated periphery of SGNP-TWLS are effectively managed through targeted awareness and brief monitoring, without the need for intervention. In such cases, allowing the leopard an undisturbed passage often leads to a natural resolution, as the animal typically avoids human contact on its own. Awareness is critical in these instances, fostering coexistence and minimising negative interactions.

Through 16 awareness sessions, we, along with the Forest Department staff & volunteers of Mumbaikars for SGNP (MfSGNP) engaged with over 1,000 citizens, equipping them with the knowledge to safely share space with leopards.

One notable case occurred in July 2023, when a leopard was sighted on an active television set at Dadasaheb Phalke Film City, Goregaon (Figures 14 - 16). In response, we swiftly installed camera traps and conducted awareness sessions on-site with the Forest Department staff, ensuring the safety of both people and wildlife.

Fig 14: Team members & Forest Department staff surveying the television set to deploy camera traps.
Credits: Shivam Shinde/ WCS-India

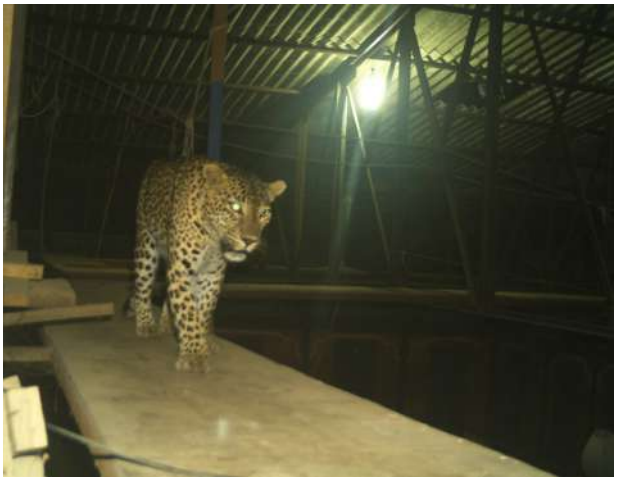


Fig 15: Deploying camera traps to monitor leopard movement. Left: Team members deploying a camera trap on the television set. Right: Leopard photo-capture from the camera trap. Credits: Maharashtra Forest Department/ WCS-India

Fig 16: An illustration created for public awareness depicting this unique instance of humans & leopards sharing spaces. Credits: Jessica Luis/ Rucha Bhave/ WCS-India

Fig 17: Glimpses of awareness sessions conducted following complains of leopard sightings.
Credits: Nikit Surve/MfSGNP/ WCS-India

LEOPARD RESCUE OPERATIONS

Due to the proximity of human settlements to the forests of SGNP and TWLS, leopard sightings in residential areas are frequent. Upon receiving such reports, we collaborate with the Forest Department to assess the situation, surveying the site for signs of leopard presence and deploying camera traps to confirm and monitor activity. Awareness sessions are promptly conducted for the residents to mitigate the risk of negative human-leopard interactions.
In cases where capturing the leopard is necessary for the safety of both the animal and the community, we assist the Forest Department in the rescue operation. Our ongoing monitoring data proves valuable in understanding the leopard's movement patterns and recommending suitable release sites. During the project period, three such rescue operations were conducted.

Leopard rescued from Gorai-Uttan

On 24th March 2023, a female leopard was trapped in a cage at Keshav Shrushti, Uttan, a human-dominated mangrove area away from the western edge of SGNP, close to the coast. Our team assisted the Forest Department to safely rescue and release the leopard, with help from the Uttan Police & Fire Departments (Figure 18). After the release operation, the leopard was monitored using camera traps near the release site.

Fig 18: Team members inspect the leopard trapped in the cage, before shifting for release.
Credits: Maharashtra Forest Department/ WCS-India

In the subsequent months, leopard sightings from Palkhadi, Uttan, were reported, and camera traps were deployed on 4th August, 2023, to monitor the leopard activity with the Forest

Department staff. The camera trap images revealed that the previously rescued leopard individual had returned to the area. As the leopard persisted in the region, continuous monitoring using camera traps continued till February 2024, along with regular awareness sessions with team members of SARRP (Figure 19).

Fig 19: Awareness session at Uttan with the SARRP team members. Credits: WCS-India

Leopard cubs found in Aarey Milk Colony

On 16th January 2024, three leopard cubs were found in a deserted biogas pit in Aarey Milk Colony (Figure 21). The biogas pit was situated close to a busy road and cattle shed, warranting immediate action. Our team members promptly assisted the Forest Department staff to control the crowd and cordon off the area to ensure the safety of the cubs.

Fig 20: Team members discussing the course of action with Dr Vinaya Jangle, Chief Veterinary Officer, SGNP Rescue Team. Credits: Veerendra Naidu/ WCS-India

Fig 21: The leopard cubs found inside a deserted biogas pit in Aarey Milk Colony.
Credits: Shivam Shinde/ Maharashtra Forest Department/ WCS-India

Live monitoring cameras were deployed to monitor the leopard cubs around the clock. Camera traps were deployed in the periphery of the spot to check for the mother of these cubs.
As the mother did not return to the spot after two days, a reunion was attempted after shifting the leopard cubs to an open space. After repeated unsuccessful attempts, the cubs were shifted to the leopard rescue center in SGNP. Our team with other like-minded volunteers assisted the Forest Department and the SGNP Rescue team with all logistical support in this operation.

Leopard rescued from Vasai Fort

During the camera-trapping exercise in TWLS, news of a leopard being spotted at Vasai Fort after colliding with a motorcycle reached us on 30th March 2024. The leopard had escaped unharmed. The Vasai Fort is an archaeological tourist site in Vasai city, approximately 10 kilometres from the boundary of TWLS. It has a high density of humans, mainly from the fishing community living in the fort, while tourists also frequent the area.

Camera traps were installed with support from the Forest Department staff and volunteers of the Wildlife Welfare Association (WWA) to monitor the leopard's movement in the area. Photo captures confirmed the presence of an adult male leopard. Upon matching the rosettes, the leopard was identified as 2024_LT2, photo-captured inside TWLS three weeks before this incident (Figure 22). The leopard had travelled unnoticed for around nine kilometres (straight line distance) through salt pans and dense human settlements, crossing roads and two railway lines from TWLS to reach Vasai Fort (Figure 23).

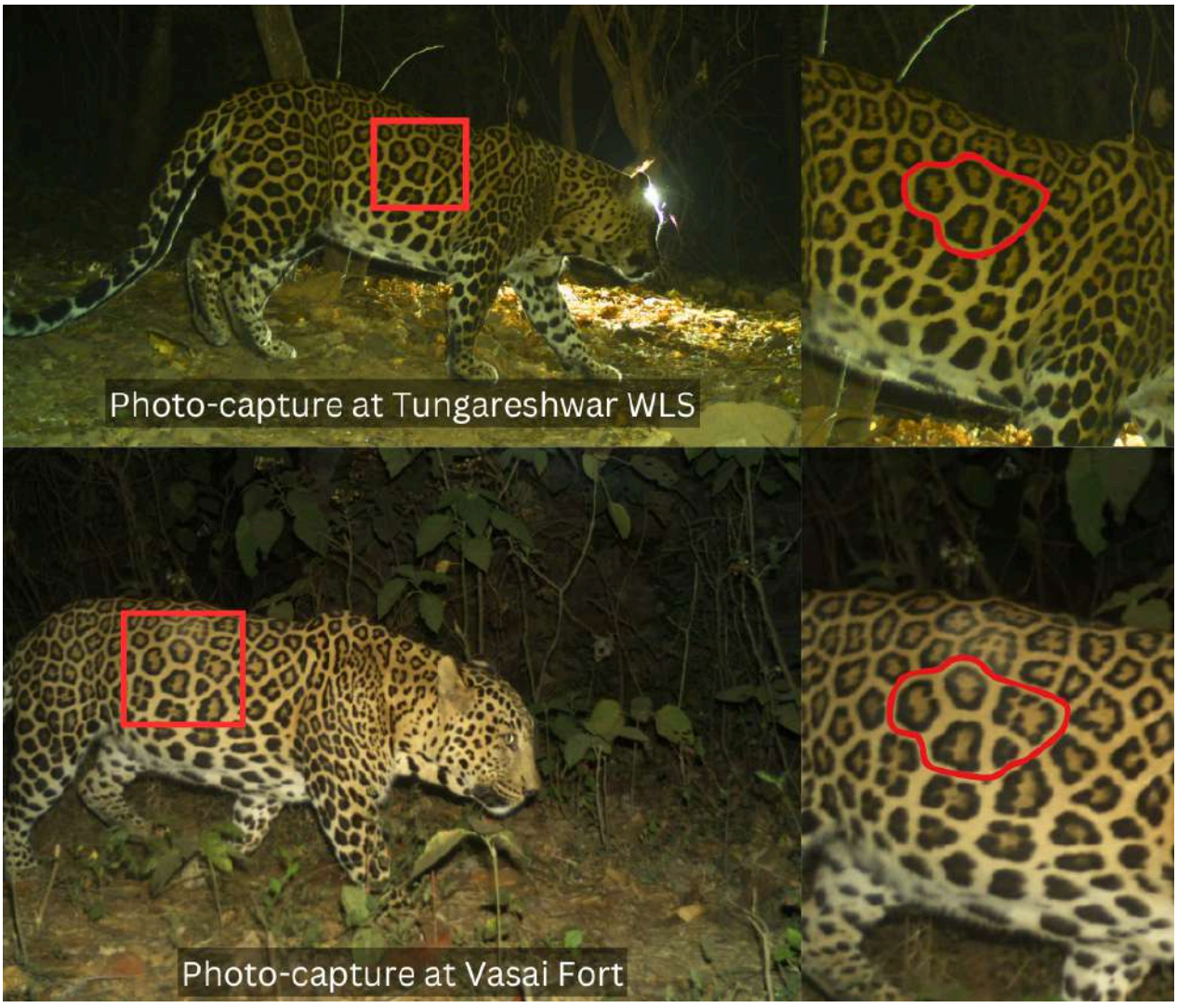


Fig 22: Identification of the leopard individual at Vasai Fort using rosette patterns. Top: Photo-capture from TWLS; Bottom: Photo-capture from Vasai Fort. Credits: Maharashtra Forest Department/ WCS-India

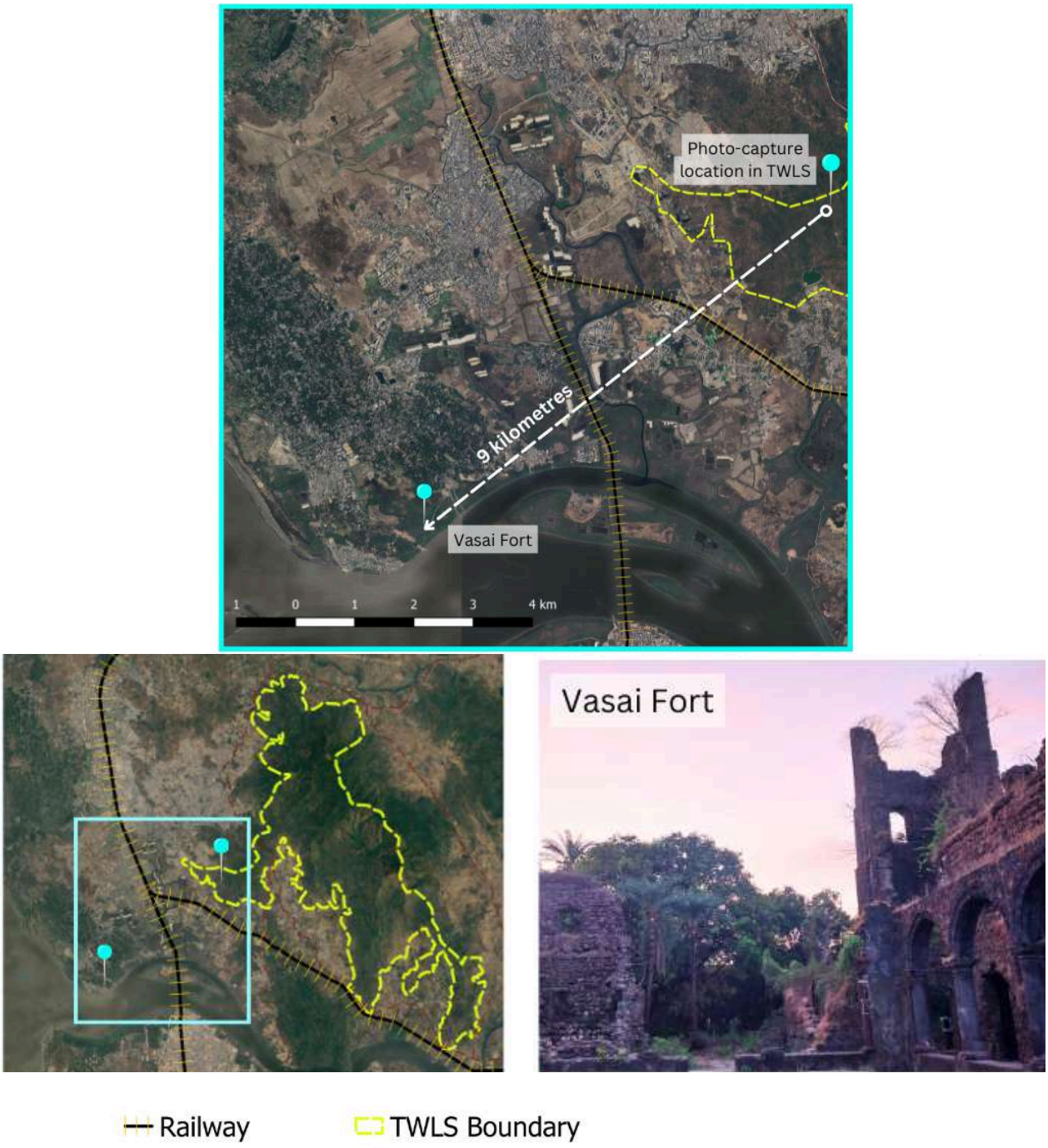


Fig 23: Location of Vasai Fort relative to the photo-capture site of 2024_LT2 in TWLS.
Credits: Veerendra Naidu/ WCS-India

Continuous camera-trapping revealed that 2024_LT2 persisted in the fort area and was photo-captured almost every night. During the day, when human presence was high, the leopard resided inside the fort tunnels and internal passageways and roamed the area at night. There were no reports of attacks on humans. The Forest Department restricted human movement during the night to avoid any negative interactions. Awareness sessions and necessary dialogues with stakeholders were facilitated by the Forest Department, WWA and our research team members (Figure 25).

Fig 24: Team members surveying the Vasai Fort with Forest Department and Wildlife Welfare Association (WWA) members. Credits: Shivam Shinde/ WCS-India

Fig 25: Team members conducting an awareness session for the locals at Vasai Fort with the Forest Department and Wildlife Welfare Association (WWA) members. Credits: Veerendra Naidu/ WCS-India

The leopard stayed at Vasai Fort for approximately 25 days. Owing to the proximity to human settlements, the leopard was captured to avoid any risk to the leopard or people in the area. Based on the evidence of our camera-trapping exercise, the leopard was released back into TWLS. The collaborative efforts of the Forest Department, WWA and the WCS-I team ensured smooth and efficient management of this situation.

CAPACITY BUILDING, TRAINING AND WORKSHOPS

A key objective of the project was to build the capacity of Forest Department personnel and other stakeholders in research methodologies, dealing with negative human-leopard interactions, and mitigation strategies. This included technical training on camera trapping and interactive sessions focused on developing practical solutions for mitigating negative human-wildlife interactions. These efforts aimed to equip staff & stakeholders with the skills needed to independently manage diverse field situations.

Importantly, the training extended beyond SGNP and TWLS, reaching multiple states across the country (Figure 27). Through 13 sessions, we successfully trained over 600 frontline staff and stakeholders.

A notable activity was the 'Leopard Conflict Mitigation – Field Training & Workshop' for 24 staff members of the Department of Forests & Wildlife, Government of National Capital Territory of Delhi (DoFW, GNCTD) in SGNP & Junnar. The trainees visited SGNP, Mumbai, and Junnar, Pune, in two batches of 15 and nine members. The training was conducted over six days in July (21st to 26th) and September (31st August to 5th September), respectively.

Extensive sessions aimed at providing insights into both rural and urban contexts of human-leopard interactions, with site visits to Junnar and SGNP, were conducted. The training was structured as a mix of indoor and outdoor sessions, hands-on demonstrations, and interactions with various stakeholders (Figure 26). The training allowed the participants to gain practical knowledge on the mitigation and management of human-leopard interactions.


Fig 26: Glimpses of the training module conducted for the staff from DoFW, GNCTD including a mix of indoor, outdoor and hands-on sessions. Credits: Veerendra Naidu/ Nikit Surve/ Dipti Humraskar/ WCS-India.


Fig 27: Training sessions for Forest Department staff. Top: Nikit Surve interacting with Forest Guard trainees at Udaipur training academy. Bottom L & R: Camera trapping training workshops for Forest Department staff of SGNP & TWLS. Credits: Nikit Surve/ WCS-India

ON-GROUND CONSERVATION ACTION

The Aarey Milk Colony (AMC) is an important part of SGNP, as it hosts rich biodiversity, frequently used by wild species, especially leopards. These animals frequently cross high traffic roads in the area and are exposed to the risk of collisions with vehicles, leading to wildlife road kills. The mitigation measures focused on facilitating animal movement through underpasses and culverts on the main road, and speed breakers on the internal roads in AMC.

A detailed survey was conducted, and the construction of 31 underpasses on the road from Aarey to Powai and Marol was recommended to the Brihan Mumbai Municipal Corporation (BMC) by the Conservator of Forest & Park Director, SGNP.

After the road construction was initiated, we assessed the proposed underpasses in January and April 2024. The status of the construction, dimensions, and condition of the culvert in terms of effectiveness for wildlife use was assessed (Figure 28). The findings were promptly conveyed to the authorities for further action.

Fig 28: Team members assessing the dimensions and status of proposed culverts.
Credits: Sanyukta Kasbekar/ WCS-India

In January 2025, the Public Works Department took up repairs of the internal roads in AMC, which presented a good opportunity to construct speed-breakers on the internal roads as a preventive measure. A preliminary assessment of the roads was conducted with members of the Aarey Urban Joint Forest Management Committee to identify locations for constructing speed-breakers near wildlife crossing points. A formal request with GPS location details of the proposed speed-breakers was submitted to the Maharashtra Forest Department by our team members on behalf of the committee.

RECOGNITION OF WORK

Fig 29: Team members with Deputy Director Smt Revati Kulkarni & ACF Karishma Kawade at the award function. Credits: WCS-India

Felicitated by the Forest Minister of Maharashtra, Shri Sudhir Mungantivar

In an event held in Sanjay Gandhi National Park in January 2024, then Forest Minister, Shri Sudhir Mungantivar, Maharashtra State, felicitated the WCS-I team for their contribution towards leopard research and conservation in the landscape.

Impact Award at Wildlife Tourism Conclave and Awards

The 'Wildlife Tourism Conclave and Awards' is an annual event held at the Nature Interpretation Centre (NIC), SGNP, aimed at recognising individuals contributing to wildlife conservation. Nikit Surve was presented with an 'Impact Award' recognising his work on human-leopard interactions in Mumbai.

Fig 30: Nikit Surve accepting the 'Impact Award' at the Wildlife Tourism Conclave and Awards, SGNP. Photo credits: Veerendra Naidu/ WCS-India

PUBLIC ENGAGEMENT EVENTS

Public engagement plays a pivotal role in fostering curiosity and a sense of responsibility toward Mumbai's leopards and their unique urban ecosystem. By sharing our fascination for this extraordinary coexistence, we aim to inspire appreciation for the presence of wildlife in human-dominated landscapes and promote a sense of ownership towards this urban wildlife. Nature trails and workshops serve as vital tools in this effort, offering a firsthand glimpse into human-wildlife coexistence.

Through these initiatives, we created an opportunity for over 4000 citizens to understand and join our work or simply gain a deeper respect for urban wildlife, with every conversation adding momentum to the broader conservation narrative. These efforts not only raise awareness but also build a community committed to preserving Mumbai's biodiversity.

A three-day event was organised at the Byculla Zoo to commemorate International Leopard Day. Multiple displays like camera trapping, radio telemetry, and rosette identification, alongside a small exhibition of some interesting camera trap images and illustrations, were set up. The Leopard Day event attracted a lot of people and created awareness of the activities conducted by WCS-I on leopards in Mumbai (Figures 31-34).

Fig 31: Team member explaining the process of rosette identification of leopards. Credits: WCS-India

Fig 32: An open drawing stall was setup for kids to paint their own leopard. Credits: WCS-India

Fig 33: Team members explaining radio telemetry to members of the public. Credits: WCS-India

Fig 34: Team members are explaining the use of camera traps for monitoring wildlife. Credits: WCS-India

Apart from this event, nature trails, workshops, public talks and hands-on sessions for the public were conducted regularly to help understand the biodiversity and conservation initiatives of Mumbai.

Fig 35: Team members engaging with the public at the 'Wildlife Tourism Conclave & Awards'. The team raised awareness about human-leopard coexistence in the landscape and demonstrated research equipment like camera traps. Credits: Nikit Surve/ WCS-India.

Fig 36: Glimpses of nature trails & camera trap sessions held for the public. Credits: WCS-India/ BNHS-CEC

Fundraiser & awareness stalls at WeWork buildings in Mumbai

An interactive fundraising and awareness exhibition was organized at five WeWork offices in Mumbai from 5th to 9th August 2024. The buildings covered were Enam, Raheja, Oberoi, Spectrum & 247 Park.

The display consisted of videos of the urban wildlife in Mumbai and demonstrations of various equipment, like camera traps and radio collars that are used for research. The WCS-I team actively engaged with the members and explained the ongoing research on the leopards of Mumbai. Interesting activities like leopard rosette matching & drawing leopard rosettes were conducted. The volunteering opportunity garnered a good response.

Fig 37: Team members explaining the research on the Urban Biodiversity in Mumbai at the WeWork offices.
Credits: Nikit Surve/ WCS-India

Fig 38: Nikit Surve gave a short presentation focusing on our research on Mumbai's leopards.
Credits: Veerendra Naidu/ WCS-India

Nature trails for WeWork members

WeWork and WCS-India jointly organised nature trails for WeWork members to experience the urban biodiversity of Mumbai. To commemorate World Wildlife Conservation Day, a guided nature trail was conducted in Aarey Milk Colony, where participants observed langurs, diverse birdlife, and leopard signs, along with a live demonstration of camera-trapping techniques used in wildlife research. The walk offered valuable insights into Mumbai's unique human-leopard coexistence and conservation efforts.

Fig 39: Glimpses of the nature trail for WeWork members in Aarey Milk Colony, hosted on the occasion of World Wildlife Conservation Day. Credits: Hrithika CA/ WCS-India

In addition, as part of the Global Backyard Bird Count (GBBC), bird-watching sessions were held in Mumbai and Bengaluru, where participants documented 46 bird species across two urban green spaces—Maharashtra Nature Park, Mumbai and Lalbagh, Bengaluru. These experiences helped participants appreciate urban avifauna and understand the ecological significance of citizen science initiatives like GBBC.

Fig 40: Glimpses of the nature trail for WeWork members in Aarey Milk Colony, hosted on the occasion of World Wildlife Conservation Day. Credits: Rujan Sarkar/ WCS-India

SCIENCE COMMUNICATION

Findings from the project activities were presented at a few scientific and student conferences, receiving enthusiastic responses and constructive feedback. These opportunities significantly broadened our reach, bringing our research on human-wildlife coexistence into the global spotlight and fostering greater awareness of our initiatives.
Our team presented at nine conferences, reaching over 500 scientists and students in the process.

Nikit Surve spoke about the project at the 'Pathways Europe: Human Dimensions of Wildlife' conference held in Cordoba, Spain, in October 2024. His presentation revolved around the research and awareness initiatives being undertaken in Mumbai to understand human-leopard interactions and promote coexistence.

Fig 41: Nikit Surve presented at the Pathways Europe: Human Dimensions of Wildlife conference at Cordoba, Spain. Credits: WCS-India

Veerendra Naidu presented the research work in Tungareshwar Wildlife Sanctuary (TWLS) in a talk titled 'Pugmarks among footprints: Persistence of mammalian carnivores in the human-dominated landscape of Tungareshwar WLS' at the 'Students Conference on Conservation Science' (SCCS-Bng) held at the Indian Institute of Science, Bengaluru in October 2024. His presentation shed light on the leopard population estimation in TWLS, along with a preliminary study on small carnivores in the protected area.

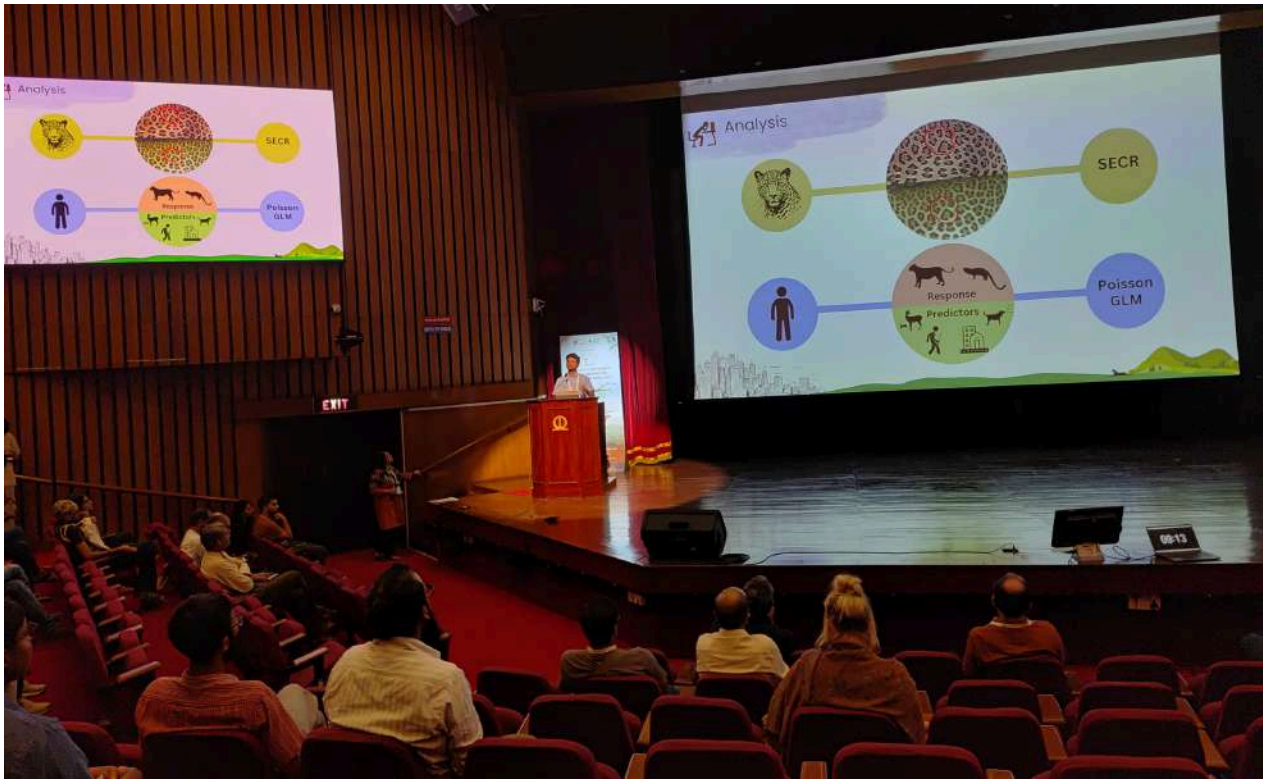


Fig 42: Veerendra Naidu presented a student talk based on the research in TWLS at SCCS-Bengaluru 2024. Credits: Gautami Meherkar

DOCUMENTING NATURE-CULTURE ASSOCIATIONS

In India, the intricate relationship between nature and culture is deeply rooted in traditions, beliefs, and practices (Aiyadurai, 2016; Govindrajan, 2019). Many communities, such as the *Bishnois* and *Warlis*, view nature as sacred, integrating wildlife and ecosystems into their spiritual and daily lives. These cultural connections promote a sense of stewardship and coexistence, fostering conservation practices that align with traditional values. Recognising and leveraging these relationships is crucial for conservation efforts, as they ensure community participation and enhance the sustainability of conservation initiatives in culturally rich landscapes like India.

With this motivation, we documented Tribal Day celebrations in SGNP (Figure 43), which serve as a powerful reminder of the deep-rooted connection that indigenous communities share with nature. These events honour traditional knowledge systems, sustainable living practices, and the cultural heritage of forest-dwelling communities who have long acted as custodians of biodiversity. Through music, dance, art, and rituals, the tribals celebrate the forest not just as a resource, but as a sacred living system.

Fig 43: Glimpses of the Tribal Day celebrations in SGNP. Credits: WCS-India

In Western Maharashtra, shrines dedicated to *Waghoba*, a deity embodying big cats like tigers and leopards, are found across multiple regions (Nair et al., 2021). For indigenous communities such as the *Warlis*, *Waghoba* is a revered figure deeply embedded in their traditions and belief systems.

The origin story of *Waghoba* paints a picture of a deity bound by his nature as a predator, occasionally preying on livestock. In this narrative, *Waghoba's* mother mediates a truce between the deity and the people, promising that if they offer yearly sacrifices and worship, *Waghoba* will protect them and maintain peace. This agreement finds expression in the annual

festival of *Waghbaras*, celebrated across Western Maharashtra, including in tribal hamlets inside SGNP. During the festival, there are multiple rituals pleading for *Waghoba's* continued benevolence, ensuring harmony between humans and big cats. Our team documented this festival inside Aarey Milk Colony, SGNP (Figure 44).

Fig 44: Waghoba pooja in the Aarey Milk Colony, SGNP. Credits: Sanjiv Valsan

Another such *Waghoba* shrine is in Jawhar, around 100 kilometres from Mumbai. Intending to document the nature-culture relationships in this landscape, we attended the annual *Waghbaras* festival in Jawhar. The rituals involved cleaning and decorating the shrine, elaborate offerings with folk music, followed by a community meal (Figure 46). The locals informed us about their faith in *Waghoba* to protect and sustain their natural surroundings.

Fig 45: Interaction with the locals to understand their cultural associations with Waghoba. The Waghoba shrine in the background. Credits: Veerendra Naidu/ WCS-India

Fig 46: The Waghoba pooja includes elaborate rituals like the cleaning and decoration of the shrine, followed by traditional songs. Credits: Parag Raorane/ Veerendra Naidu/ WCS-India

These practices indicate that communities perceive leopards not as fearsome predators but as beings with a complex identity. To them, *Waghoba*—and by extension, the leopard—is both a powerful force of nature and a protector, bound by his promise to coexist with his human kin. This nuanced perspective fosters a space where leopards are not just tolerated but accepted, allowing them to thrive not only in the physical landscape but also within the cultural fabric of human society.

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APPENDIX

List of awareness sessions

Sr no	Location	Approximate audience	Date
1	Lotus Society, Marol	20	9-Mar-23
2	Royal Hills Dindoshi	20	14-Mar-23
3	Uttan	100	24-Mar-23
4	Raheja reflections, Kandivali	40	28-Jun-23
5	Kajupada	15	1-Jul-23
6	Filmcity: 'Sukh mhanje.." set	100	18-Jul-23
7	Girikunj society	20	12-Aug-23
8	Ram Ratna Vidya Mandir, Bhayander west	25	21-Aug-23
9	Pandit Gram Vidyalaya, Yeoor	30	1-Jan-24
10	Aarey leopard cubs rescue	20	15-Jan-24
11	Vasai Fort	250	29-Mar-24
12	Anti snare drive in Aarey & Filmcity	90	20-Jun-24
13	Kolshet	5	27-Jul-24

Sr no	Location	Approximate audience	Date
14	FDCM	10	14-Sep-24
15	SRPF quarters, Goregaon	250	29-Jan-25
16	IIT Powai	200	1-Mar-25

List of conferences

Sr no	Details	Approximate audience	Date
1	Dhole conference, Devrukh, Ratnagiri	70	26-May-24
2	International Conference on HW conflict; Oxford	30	30-Mar-23
3	People, animals and waste systems; Oxford	25	17-Apr-23
4	Climate change and biodiversity loss; Jaipur	75	7-Aug-23
5	Human-wildlife Interactions conference at the Conservation Science and Innovation Laboratory (CoSI Lab), Centre of Research Development (CORD), University of Kashmir.	50	25-Sep-23
6	Tiger meeting: Thailand	20	1-Nov-23

Sr no	Details	Approximate audience	Date
7	Eco warriors India - presentation by Mallikarjuna Sir	50	15-Sep-24
8	Pathways Europe: Human dimensions of wildlife	25	22-Oct-24
9	SCCS Bangalore	200	22-Oct-24

List of stakeholder trainings

Sr no	Details	Approximate audience	Date
1	Session for local stakeholders in Nepal	12	23-Mar-24
2	Human-wildlife conflict workshop in Shuklaphanta NP, Nepal	40	24-Mar-24
3	Camera trap workshop: SGNP	30	13-Mar-23
4	CASFOS personnel training at SGNP	100	24-Mar-23
5	Training for MfSGNP volunteers	30	14-May-23
6	Wildlife Conservation Workshop, SGNP	100	9-Jun-23
7	Fire Dept staff training with MfSGNP	30	11-Aug-23

Sr no	Details	Approximate audience	Date
8	Human-wildlife conflict workshop hosted by the Gujarat Forest Department	100	1-Oct-23
9	Training for DoFW GNCTD staff: Batch - 1	16	July 2024
10	Training for DoFW GNCTD staff: Batch - 2	10	Sept 2024
11	Camera trap workshop: TWLS	25	Dec 2024
12	Camera trapping workshop at BNHS-CEC	20	Dec 2024
13	Session for Forest Guard trainees at Udaipur Forest Academy	90	11-Feb-25

List of public events

Sr no	Details	Approximate audience	Date
1	Smaran ajobaache	300	3-May-23
2	Popular talk in VIBGYOR, Kalyan	30	7-May-23
3	Photo exhibition at Inorbit Mall	500	24-Jun-23

Sr no	Details	Approximate audience	Date
4	Popular talk at IIT Powai	50	30-Aug-23
5	Popular talk in schools in Chena & Owale	80	1-Oct-23
6	Nature trail for IIHS students	20	Nov 2023
7	Wildlife Tourism Conclave & Awards 2024	100	Jan 2024
8	Felicitation by Forest Minister, Shri Sudhir Mungantivar	300	18-Jan-24
9	Wildlife Tourism Conclave & Awards 2025	150	25-Jan-24
10	International Leopard Day event, Byculla Zoo 2024	2000	3-May-24
11	Fundraiser and awareness stalls at WeWork buildings	500	5-Aug-24
12	Nature trail on World Wildlife Conservation Day	10	4-Dec-24
13	Nature trail for IIHS students	30	10-Jan-25
14	GBBC for WeWork members in Mumbai & Bengaluru	15	14-Feb-25
15	Popular talk for NMIMS Students	20	20-Feb-25

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