Li et al. *Zool. Res.* 2023, 44(4): 747−749
https://doi.org/10.24272/j.issn.2095-8137.2023.178

ZR | Zoological Research

News Open Access

Tiger reappearance in Medog highlights the conservation values of the region for this apex predator

In less than a century, Asia's largest apex predator, the tiger (*Panthera tigris*), has been relegated to isolated populations surviving in only a small fraction of its historical range. The Medog region, located in Xizang Zizhiqu (Tibet), China, is an important stronghold for this ecologically important apex predator. To enhance our knowledge of the status of tigers in the Medog region, we carried out a systematic camera trapping survey combined with socioecological data collection between April 2020 and May 2022. We surveyed a 1 769 km^2 area across the Medog region, with a total valid sampling effort of 43 163 camera days from 322 camera stations. We also collected socioecological data from 27 forest rangers. We documented tigers at eight camera trapping stations at two villages separated by the Jinzhu Tsangpo River, confirming the presence of at least one adult male individual within the Medog region. These new records were observed over 80 km northeast of the first record in 2019. Additionally, residents reported tiger sightings in 2020 and likely tiger pugmarks in 2021. These spatially and temporally separate records of tigers in the Medog region provide valuable data for informing species-oriented conservation management and highlight the importance of the region for tiger movement and population expansion. However, although encouraging, our survey also detected human activities that may threaten tigers and their potential prey. Ensuring the future survival of tigers in the Medog region entails anti-poaching patrols and long-term camera trapping efforts. In addition, it is also important to identify and establish corridors that connect the Medog region with the adjacent Zangnan region, which also harbors an important population of tigers.

The tiger species (*P. tigris*) has experienced a significant decline across its distribution range, resulting in its classification as "Endangered" on the IUCN Red List (Goodrich et al., 2022). The Bengal tiger subspecies (*P. tigris tigris*), once widely distributed in southeastern Xizang in China (Qiu & Bleisch, 1996), has also faced a marked population decline, with only a few documented records in the Medog region, primarily based on indirect evidence, such as pugmarks and livestock predation (Wang et al., 2019). To clarify the potential presence of tigers in the Medog region, we conducted a preliminary camera trapping survey between October 2018 and May 2019. With the support of the Second Tibetan Plateau Scientific Expedition and Research Program (2019QZKK0501), we established 33 camera traps in the area and captured images of tigers at two camera trapping stations located near De Ergong Village, with three independent detection events on 14 January 2019, providing the first confirmed occurrence of the species in the Medog region (Li et al., 2021b). However, whether the tiger population permanently resides in the region or is merely transient remains unclear.

To gain a better understanding of the status of tigers in the Medog region, we carried out a further systematic camera trapping survey between April 2020 and May 2022 in collaboration with the Xizang Zizhiqu Forestry and Grassland Department. The study also incorporated socioecological data from villages adjacent to the camera trapping sites. In total, the survey encompassed a 1 769 km^2 area across the Medog region, with Yianws L720 camera traps used for data collection. At each camera station, a solitary camera trap was deployed along a trail, mountain ridge, or stream, ensuring a minimum distance of 800 m from neighboring camera stations. The total valid sampling effort was 43 163 camera days from 322 operational camera stations. In addition, socioecological data were collected from 27 forest rangers to further enrich our understanding of local ecological dynamics and human-wildlife interactions.

The camera trapping survey resulted in the capture of 46 tiger images across eight stations, corresponding to 22 independent detection events occurring with a minimum interval of 24 h at the same station. To ensure the protection of this endangered species and minimize the risk of illegal activities, we are providing only the names of the villages where the records were obtained (Figure 1A). The initial record occurred on 23 January 2022, at an altitude of 2 380 m a.s.l. at Sangzhenka Village, located approximately 80 km northeast of the first record at De Ergong Village in 2019. The second record occurred on 21 February 2022, at an altitude of 2 650 m a.s.l. at Gedang Village, situated approximately 20 km northeast of the first record in January 2022. These two villages are separated by the Jinzhu Tsangpo River (Figure 1A). The time interval between the first and second detection events was 29 days. From 21 to 23 February, seven camera trapping stations captured 11 independent detection events, confirming the presence of at least one adult male individual within the Medog region. Due to the single nighttime detection at Sangzhenka Village, it remains uncertain whether the two spatially and temporally distinct records pertain to one individual tiger or two separate individuals. One month later,

Received: 14 June 2023; Accepted: 06 July 2023; Online: 06 July 2023
Foundation items: This study was supported by the Second Tibetan Plateau Scientific Expedition and Research Program (STEP, #2019 QZKK0501), Special Subsidies for Key Wildlife Conservation Project of Xizang Zizhiqu, West Light Foundation of the Chinese Academy of Sciences and China Biodiversity Monitoring and Research Network (Sino Bon)

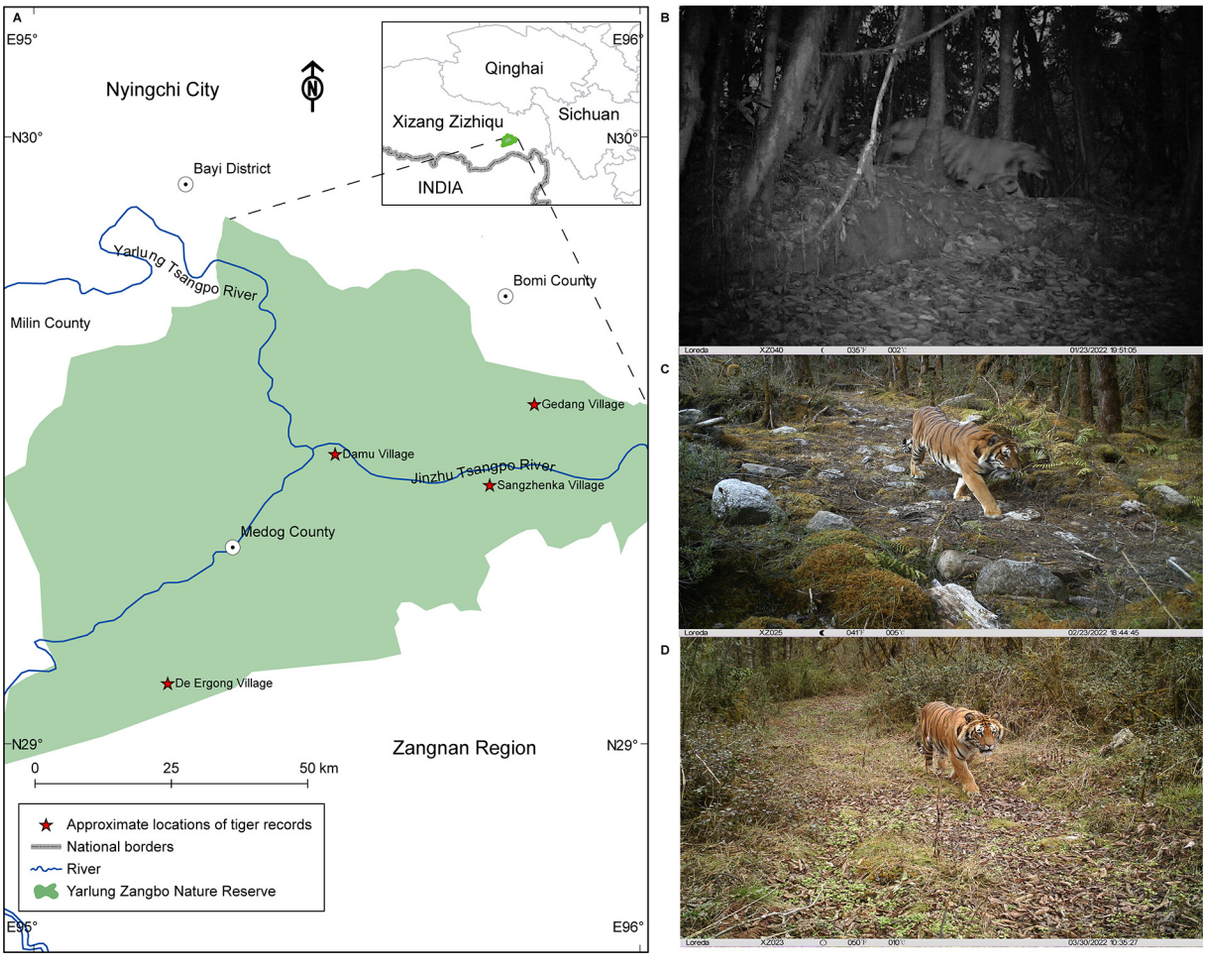

Figure 1 Approximate locations of tiger records (A) and selected photos of tigers captured by camera trapping survey in the Medog region: First detection on 23 January 2022 at Sangzhenka Village (B); detection at Gedang Village in February 2022 (C); and detections at Gedang Village in March 2022 (D)

on 23 March, tigers reappeared at two camera trapping stations at Gedang Village. Between 23 to 30 March, six camera trapping stations documented 10 independent detection events (Figure 1B–D). The photographs captured in March were identified as the same individual detected in February. The mean altitude for all recorded detections was 2 687 m a.s.l. (range: 2 380–3 139 m a.s.l.).

In addition to the camera trapping records, our socioecological survey further substantiated the recurrent presence of tigers within the Medog region. In 2020, three forest rangers from Gedang Village reported tiger sightings in the preceding 12 months, and seven respondents from the same village reported sightings of large pugmarks along their walking trails within the same time frame. The described pugmarks were left on soft mud and displayed a nearly square shape, exceeding 10 cm in both width and length, strongly indicating the likelihood of them being tiger tracks. Similarly, in 2021, nine respondents from Damu Village reported sightings of pugmarks resembling those of tigers on their walking trails in the preceding 12 months (Figure 1A).

The occurrence of spatially and temporally distinct tiger records in the Medog region holds great significance for informing species-oriented conservation management, while also highlighting the conservation priority of the region. These records contribute to our existing knowledge regarding the occurrence of tigers within the Medog region, expanding their known range towards the northeast. Furthermore, the infrequent nature of the detections suggests an extensive home range and low population density of tigers within the region. In addition, the recurrent appearances of tigers across different times and sites are indicative, as least in part, of the benefits of long-term conservation efforts by the local government. Lastly, the presence of tigers also emphasizes the importance of the Medog region for tiger movement and population expansion. According to our socioecological survey, respondents from Minlin County, Bomi County, and Bayi District of Nyingchi City reported historical sightings of tigers in the 1980s. This underscores the potential role of the Medog region as a stepping-stone to facilitate population recovery and establish broader connectivity to other potentially suitable but currently unoccupied areas. In addition, our survey detected the presence of several threatened carnivore species, including the snow leopard (*Panthera uncia*), mainland clouded leopard (*Neofelis nebulosa*), golden cat (*Catopuma temminckii*), marbled cat (*Pardofelis marmorata*), and dhole (*Cuon alpinus*), further highlighting the conservation value of the region (Li et al., 2021b). However, alongside these positive findings, our survey also identified various human disturbances, such as illegal hunting (evidenced by wire snares set on animal trails), forest resource exploitation, free-range livestock grazing, and the presence of stray dogs, which may threaten tigers and their potential prey (Li et al., 2021a). To ensure the survival of tigers in the Medog region, strict anti-poaching and anti-overgrazing strategies are

essential. Moreover, it is imperative to undertake continuous long-term camera trapping and monitoring activities while also identifying corridors that establish connections between the Medog region and neighboring Zangnan region (known as the Dibang Wildlife Sanctuary in India). Notably, 11 distinct tiger individuals were documented in the Zangnan region between 2015 and 2017 (Adhikarimayum & Gopi, 2018), suggesting the potential existence of crucial metapopulations in that area. By implementing such measures, we can potentially facilitate the preservation of important tiger populations and their gene flow between these regions.

SCIENTIFIC FIELD SURVEY PERMISSION INFORMATION

Permission for field surveys in Medog Region was granted by the Xizang Zizhiqu Forestry and Grassland Department (Approval No.: [2020]-175-2, [2021]-111 and [2022]-12).

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

X.L.J.: Conceptualization, Funding acquisition, Project administration. X.Y.L.: Conceptualization, Funding acquisition, Methodology, Investigation, Data curation, Writing – original draft, Writing – review & editing. W.Q.H.: Investigation, Data curation. H.J.W.: Data curation. All authors read and approved the final version of the manuscript.

ACKNOWLEDGEMENTS

We thank the Xizang Zizhiqu Forestry and Grassland Department and Nyingchi City Forestry and Grassland Bureau for their logistical support and authorities for permitting the study. We thank Hongqing Yang, Pengfei Zhang, Zhen Liu, Minjing Pu, Kang Luo, Changzhe Pu, and other collaborators that helped collect data.

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