

Letter to the editor

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Chinese pangolins (*Manis pentadactyla*) are not functionally extinct in China

DEAR EDITOR,

The key features of functional extinction include continuous reproductive failure, lack of new recruitment, and persistent population decline (Jarić et al., 2016; Roberts et al., 2017). However, the conclusion of functional extinction for the Chinese pangolin (*Manis pentadactyla*) by the China Biodiversity Conservation and Green Development Foundation (CBC-GDF) based on preliminary field information is unconvincing as they did not assess reproductive function or new individual recruitment of Chinese pangolin populations (Supplementary Materials).

To clarify whether the Chinese pangolin is functionally extinct, we collected and collated data from infrared camera traps, field transect line surveys, artificial rescues, enforcement seizures, interview surveys, and published literature (Supplementary Materials). A total of 237 live Chinese pangolins were discovered from January 2010 to June 2023 (Supplementary Table S1 and Figure S1) in 11 of the 17 provinces previously known to contain Chinese pangolin populations. The pangolin sites were primarily located in southeastern areas (Figure 1A), including Putuo Mountain, Lishui and Wuyanling Reserve in Zhejiang Province; Huidong, Xiangtou Mountain Reserve, Fenghuangshan Reserve, and Qimuzhang Reserve in Guangdong Province; Shanghang, Daiyunshan Reserve in Fujian Province; Xuancheng and Huangshan in Anhui Province; Xiushui, Yudu, and Ningdu in Jiangxi Province; and Wuzhishan in Hainan Province (Supplementary Table S2). A considerable majority of the Chinese pangolins (159 out of 237, or 67.1%) were detected outside of protected reserves, in contrast to only 68 individuals (28.7%) found within reserve boundaries, with the status of 10 individuals (4.2%) still uncertain. This pattern indicates that conservation efforts for Chinese pangolins need to include areas beyond designated reserves.

Among the 237 live Chinese pangolins discovered (Figure 1B–I; Supplementary Table S1), detailed individual information was ascertainable. Notably, the identified Chinese pangolins included two pregnant individuals (Figure 1I) and 46 individuals with known sex (21 females, 25 males), as well as nine cubs (Figure 1F, H) (three from Zhejiang, two from Hainan, two from Fujian, one from Jiangxi, and one from

Guangdong, with four cubs recorded after the declaration of functional extinction), 20 juveniles, 67 adults, and four senior individuals (Figure 1G). Body weight was recorded for 70 pangolins, with the smallest being a newborn cub from Shanghang in Fujian, weighing only 112 g (Figure 1H), and the largest adult weighing 6.5 kg. Additionally, the average weight was 3.06 ± 1.68 kg, with seven individuals weighing less than 1.5 kg (10.0%), 24 individuals weighing between 1.5 and 2.5 kg (34.3%), and 39 individuals weighing more than 2.5 kg (55.7%). The Chinese pangolin population included pregnant females (Figure 1I, $n=2$), newborn cubs ($n=9$), females (Figure 1C, $n=21$), juveniles capable of reproduction (Figure 1D, $n=20$), and several senior individuals (Figure 1G, $n=4$). These observations demonstrate that the Chinese pangolin population retains normal reproductive capacity with potential for growth. The continual recruitment of new individuals to the population also contradicts the criteria for functional extinction. Consequently, it can be concluded that the Chinese pangolin in China does not meet the definition of functional extinction.

In 2020, the Chinese government enacted a comprehensive prohibition on wildlife utilization and removed the Chinese pangolin from the Chinese Pharmacopoeia. These measures aimed to reduce the use of wild Chinese pangolins for culinary and traditional medicinal purposes (Chinese Pharmacopoeia Commission, 2020). Concurrently, the Chinese government established the Chinese Pangolin Conservation and Research Center and elevated the species to a first-class national protected animal. These efforts strongly suggest an intensification of protective measures for the Chinese pangolin, coupled with a more rigorous prosecution of illegal activities. Since 2007, the Chinese government has been promoting the ecological civilization construction initiative, resulting in the gradual restoration of degraded wildlife habitats, including those of the Chinese pangolin. Furthermore, extensive monitoring data have revealed a progressive increase in the Chinese pangolin population (Zhang et al., 2021), as well as many other wild animals, such as the Asian elephant (*Elephas maximus*) (Tang et al., 2023), wild boar (*Sus scrofa*), muntjac (*Muntiacus reevesi*), and silver pheasant (*Lophura nycthemera*) (unpublished data). The Chinese pangolin populations are showing promising signs of recovery, benefiting from enhanced protection and

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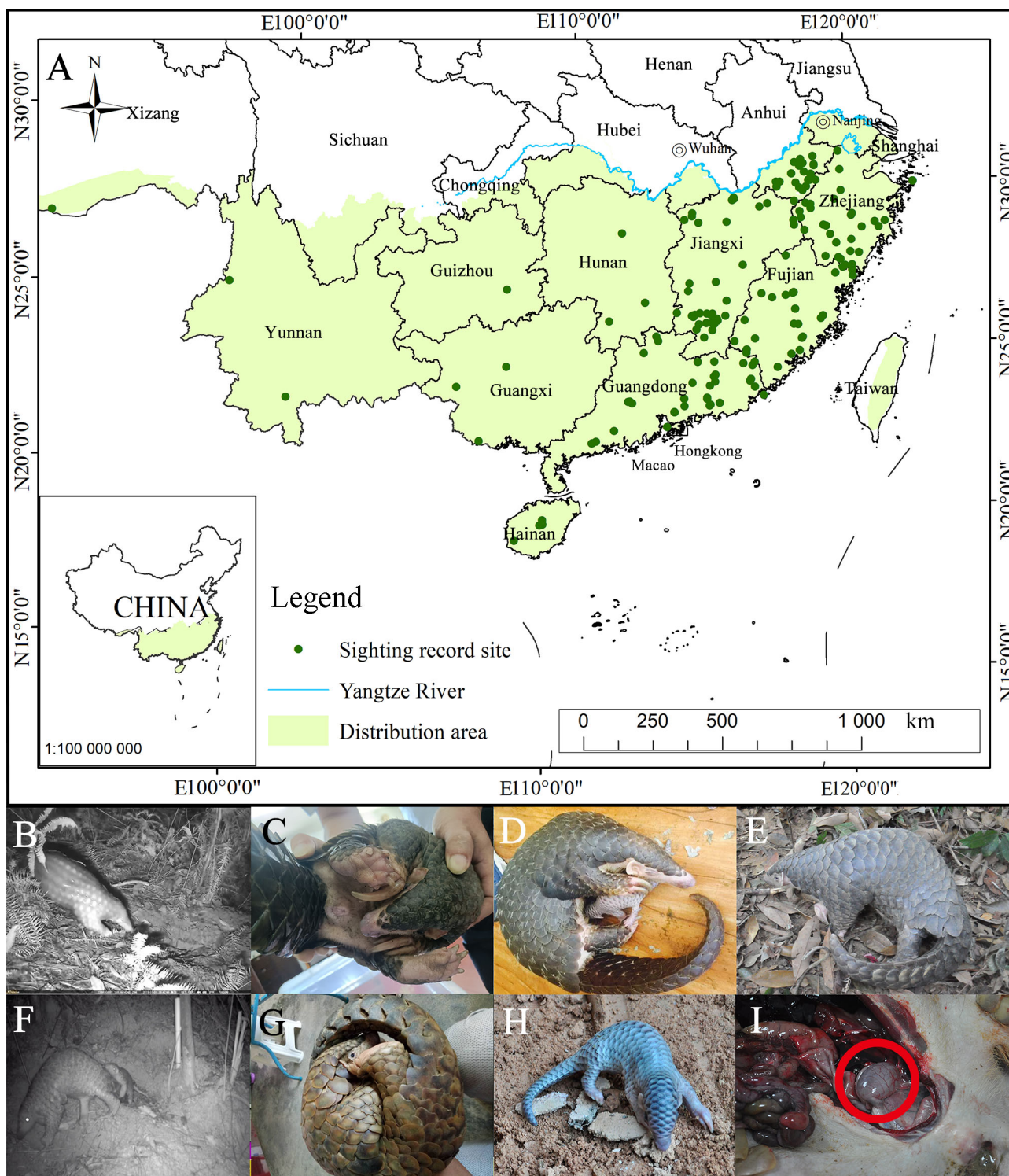


Figure 1 Chinese pangolins sighting locations (total of 237) and selected living Chinese pangolin photos

A: Historical distribution range of Chinese pangolins and sighting locations in China from January 2010 to June 2023. Sightings were mainly distributed in Guangdong (60 individuals), Zhejiang (48 individuals), Jiangxi (51 individuals), Fujian (33 individuals), Anhui (21 individuals), and Hainan (14 individuals). Sightings were also recorded sporadically in Guangxi (three individuals), Yunnan (two individuals), Guizhou (one individual), Hunan (three individuals), and southern Xizang (one individual). Nonetheless, six provinces and cities (Jiangsu, Shanghai, Hubei, Sichuan, Chongqing, and Henan), previously identified in studies and records as within the distribution range of the Chinese pangolin, reported no sightings of live individuals. B: Photography with an infrared camera (Chaozhou in Guangdong, 2023, photo by Pei-Zhao Ye). C: Rescued adult female (Jiujiang in Jiangxi, 2022, photo by Bai-Qiang Hu). D: Rescued juvenile subadult (Shanghang in Fujian, 2015, photo by Shi-Bao Wu). E: Adult individual sighted during a field survey (Huizhou in Guangdong, 2020, photo by Shi-Bao Wu). F: Female adult carrying her cub photographed with an infrared camera (Heyuan in Guangdong, 2022, photo from Forestry Administration of Guangdong Province). G: Rescued senior individual (Wuzhishan in Hainan, 2017, photo by Shi-Bao Wu). H: Rescued unweaned cub (112 g, Longyan in Fujian, 2015, photo by Shi-Bao Wu). I: Fetus (marked by red circle) inside uterus of a dead pregnant female (Qiongzhang in Hainan, 2018, photo by Shi-Bao Wu).

conservation measures. As such, there is a strong basis for optimism regarding the gradual resurgence of the Chinese pangolin in China.

SCIENTIFIC FIELD SURVEY PERMISSION INFORMATION

Permission for field surveys in China was granted by the National Forestry and Grassland Administration. No specimens were collected during the survey.

SUPPLEMENTARY DATA

Supplementary data to this article can be found online.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

S.B.W. designed the study and reviewed and checked the manuscript thoroughly. Z.C.L., P.C., S.B.W., A.M., C.L., F.H.Z., and J.K.S. conducted field surveys and collected the data. Z.C.L., P.C., and S.B.W. drafted the manuscript and analyzed the data. All authors read and approved the final version of the manuscript.

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REFERENCES

- Chinese Pharmacopoeia Commission. 2020. Chinese Pharmacopoeia. Beijing: China Medical Science Press. (in Chinese)
- Jarić I, Gessner J, Solow AR. 2016. Inferring functional extinction based on sighting records. *Biological Conservation*, **199**: 84–87.
- Roberts DL, Jarić I, Solow AR. 2017. On the functional extinction of the Passenger Pigeon. *Conservation Biology*, **31**(5): 1192–1195.
- Tang YJ, Yang C, Yang ZC, et al. 2023. Population dynamics of wild Asian elephants over the past fifty years. *Acta Theriologica Sinica*, **43**(5): 593–607. (in Chinese)
- Zhang FH, Wang WH, Mahmood A, et al. 2021. Observations of Chinese pangolins (*Manis pentadactyla*) in China. *Global Ecology and Conservation*, **26**: e01460. (editor modified)