# Population dynamics and conservation status of the white-headed langur in the Chongzuo forest fragments, Guangxi, China

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**Abstract** We present the results of two population surveys conducted 10 years apart (December 2010–February 2011 and December 2020–January 2021) of the Critically Endangered white-headed langur *Trachypithecus leucocephalus* in the Chongzuo White-Headed Langur National Nature Reserve, Guangxi Province, China. In the first survey, we recorded 818 individuals in 105 groups and 16 solitary adult males. In the second survey, we recorded 1,183 individuals in 128 groups and one solitary adult male. As a result of government policies, poaching for food and traditional medicine is no longer a primary threat to these langurs. However, severe forest loss and fragmentation caused by human activities could limit any future increase of this langur population.

**Keywords** China, conservation status, Critically Endangered, Guangxi, forest fragment, population dynamics, *Trachypithecus leucocephalus*, white-headed langur

The white-headed langur *Trachypithecus leucocephalus*, a primate species endemic to China, is restricted to a 200 km² area of limestone hills in southern Guangxi Province (Zhou & Huang, 2021) and is categorized as Critically Endangered on the IUCN Red List (Bleisch & Long, 2020). This species is one of a group of seven allopatric species of Endangered and Critically Endangered langurs that inhabit limestone forests characterized by highly porous and soluble rock and karst formations that contain steep cliffs, fissures, sink holes and caves (Zhou & Huang, 2021). White-headed langurs are reported to have experienced population declines over the past 35 years (Bleisch & Long, 2020). In 1999, the total remaining population was estimated to be c. 600 individuals (Huang et al., 2002). White-headed langurs now only occur in the Chongzuo White-Headed Langur National Nature Reserve and Nonggang National Nature Reserve, 100 km to the west, with 94% of the population in the former, and only 6% in the latter (Zhou & Huang, 2021).

The White-Headed Langur National Nature Reserve is in south-west Guangxi Province. This Reserve comprises four areas: Bapen (4,370 ha), Banli (2,830 ha), Daling (1,771 ha) and Tuozhu (16,608 ha; Fig. 1). The Reserve is fragmented by sugarcane plantations, roads and settlements. We conducted an initial population census of white-headed langurs during December 2010–February 2011. Ten years later, we conducted a second census during December 2020–January 2021. Both census teams were composed of 20 observer groups. Based on our long-term observation of white-headed langurs, we conducted censuses during 6.30–10.00 and 15.00–18.30.

To census the langur population, we used a route census and a partition-spot survey as outlined in Li & Rogers (2007). Because the limestone hills are fragmented by plantations and roads, we divided the Reserve into seven unequal-sized survey areas and assigned particular survey areas to individual survey groups. We used available paths as route lines. We surveyed neighbouring clusters of limestone hills on the same day to avoid repeated counts of the same langur group moving across neighbouring areas. We walked a total of 138 routes of 1.5–2.0 km in length in 2010/2011. We re-surveyed the same routes in 2020/2021 using the same methodology. These survey routes covered all potential areas of langur distribution in the Reserve. When we detected a langur group, we collected data on group size and recorded the location of the group on a 1:10,000 topographical map. The numbers of groups and individuals we report should be considered indices of population size rather than a true population size.

In the 2010/2011 survey we recorded a total of 818 individuals in 105 groups and 16 solitary adult males. Mean group

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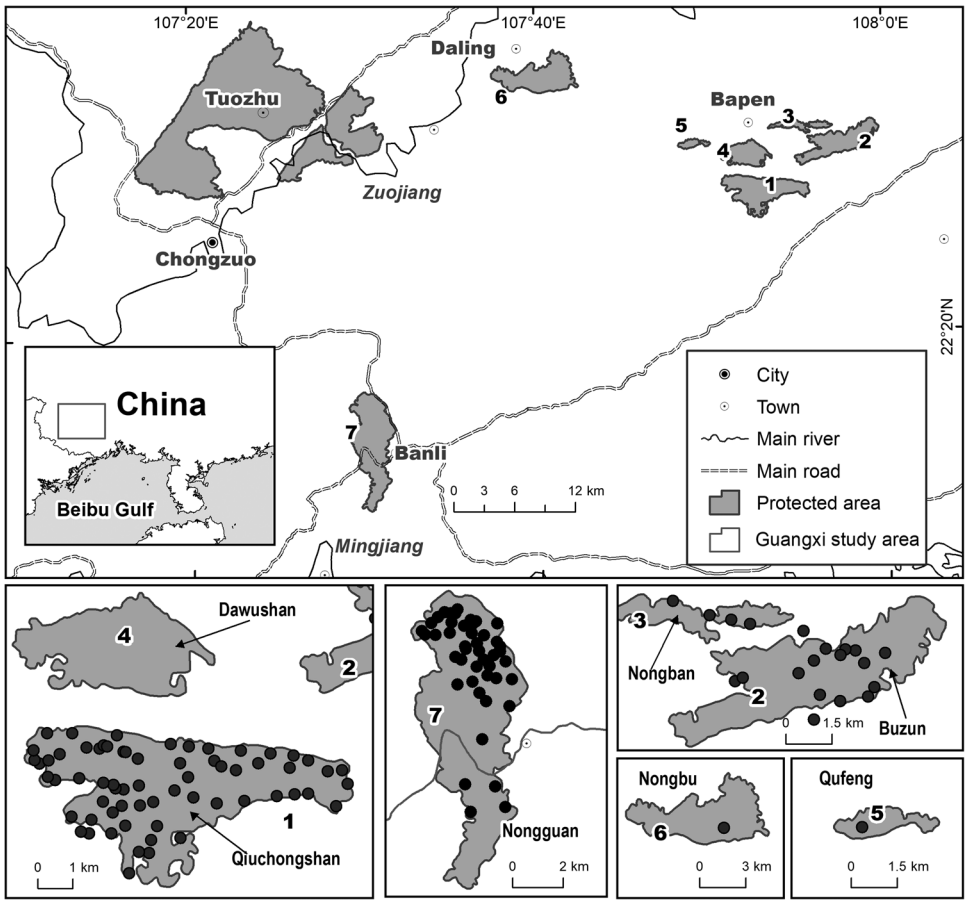


FIG. 1 The distribution of the white-headed langur *Trachypithecus leucocephalus* in the Chongzuo White-Headed Langur National Nature Reserve, southern Guangxi Province, China, as recorded in the second survey, in 2020/2021.

size was 7.7 ± SD 4.3 (range 2–31). Although we found white-headed langur groups in five forest fragments, 89% of groups were observed in only two fragments (60 groups in Qiuchongshan and 33 in Nongguan, and nine in Buzun, two in Nongban and one in Qufeng; Fig. 1). We calculated the index of langur population density in 2010/2011 to be 10 individuals/km² and the total area occupied by all observed groups was 81.6 km².

In 2020/2021, we recorded 1,183 individuals in 128 groups and one solitary adult male in the Reserve, and 56 individuals in six groups outside the Reserve (Fig. 1). Mean group size was 9.2 ± SD 5.1 (range 2–39). The total area occupied by all observed groups was 99.3 km². Over the 10-year period, the number of langur groups observed increased from 60 to 69 in Qiuchongshan (+15%), from 33 to 45 in Nongguan (+36%), from nine to 14 in Buzun (+56%) and from two to four in Nongban (+100%; Fig. 2). In both surveys, we recorded only a single langur group in Qufeng and no langur groups were observed in the Dawushan fragment of the Reserve. We recorded one group in the Nongbu fragment in 2020/2021 but not in 2010/2011 (Fig. 1). The index of langur population density in 2020/2021 was 15 individuals/km². Thus, over this 10-year period the white-headed langur group size increased by 18%, the numbers of groups and individuals observed increased by 22 and 45%, respectively, and the index of population density increased by 50%.

Illegal poaching for food and traditional medicine has been recognized as the main threat to the white-headed langur (Huang et al., 2002). Soon after the Chinese government created Chongzuo and Nonggang national Nature Reserves and white-headed langurs were listed as a Class I protected wild animal species in China, poaching was actively punished by the government (Huang et al., 2002). Thus, a marked reduction in poaching appears to offer the strongest explanation for the dramatic increase in the size of this white-headed langur population in the Reserve over the past 2 decades.

At present, habitat loss and degradation are the main threats to the long-term survival of white-headed langurs (Huang et al., 2002). Although the size of this population has increased over the past 2 decades, the distribution area has decreased, from 200 km² in 1999 to 99.3 km² in 2021. Prior to the founding of the Reserve, almost all of the relatively flat or arable land within the Reserve had been deforested for the cultivation of crops such as peanuts, green beans and sugarcane. These cultivated lands extend to the slopes of the limestone hills, which contain important feeding sites and are the last remaining habitat for the langurs. These dramatic habitat changes can affect langur

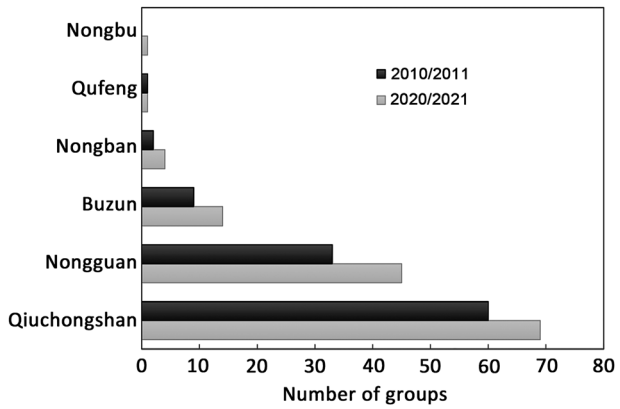


FIG. 2 Numbers of white-headed langur groups in the Chongzuo White-Headed Langur National Nature Reserve (Fig. 1) in 2010/2011 and 2020/2021.

population survival (Li, 2000; Huang et al., 2002). Thus, a priority must be to reforest and restore the natural limestone habitat of white-headed langurs. In this regard, in 2021, the local Chongzuo government officially enacted the Habitat Conservation Regulation of White-Headed Langur in Chongzuo, which bans by law habitat destruction and natural habitat conversion within the current white-headed langur range.

Forest fragmentation is another main threat to the survival of white-headed langurs in China (Huang et al., 2008; Wang et al., 2017). In the Reserve, white-headed langur subpopulations are distributed across six forest fragments that are isolated from each other by agricultural landscapes and roads. The smallest fragment is only 1.5 km² and the largest is 28 km². Gene exchange amongst these six subpopulations is not possible and this will probably result in a marked reduction in subpopulation genetic diversity and an increase in inbreeding, and affect the genetic structure of the population negatively. Low genetic diversity and significant population divergence amongst subpopulations of white-headed langurs have been reported previously (Wang et al., 2017), suggesting that the white-headed langur populations in Qiuchongshan and Nongguan should be considered as two distinct management units. Habitat corridors for migration need to be built between fragmented forest patches and isolated subpopulations to promote gene flow.

We observed > 77% of the white-headed langur groups in the Qiuchongshan and Nongguan forest fragments (Fig. 1), with high population density index values for these regions (32.9 individuals/km² in Qiuchongshan, 17.9 individuals/km² in Nongguan). The population density index values of white-headed langurs in these areas are higher than those of other *Trachypithecus* species (e.g. *Trachypithecus francoisi*, 0.9 individuals/km², Li et al., 2007; *Trachypithecus geei*, 0.88 individuals/km², Thinley et al., 2019). The combination of rapid population growth and habitat loss and isolation is the main reason for the high population density of white-headed langurs in the Reserve. The flat lands within and at the boundaries of the Reserve belong to local villages (Huang et al., 2002), and we recommend the government purchases these lands to expand suitable langur habitat through the restoration of native forest and construction of biological corridors between forest patches. This would help relieve the ecological pressure caused by high population densities. To compensate villagers for any economic losses resulting from such land purchase, the local government could develop langur-oriented ecotourism, sharing revenue with villagers in return for conservation easements on these lands, and community conservation action such as assisting natural regeneration and/or community patrolling.

In conclusion, expanding the area of the Chongzuo White-Headed Langur National Nature Reserve, constructing biological corridors and implementing a dedicated programme of forest restoration are the most effective actions that could be taken to protect and increase the population size of the Critically Endangered white-headed langur. Additionally, providing income, employment and conservation-orientated education to local inhabitants and communities could also play an important role in protecting the species.

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**Conflicts of interest** None.

**Ethical standards** This research abided by the *Oryx* guidelines on ethical standards.

## References

BLEISCH, B. & LONG, Y. C. (2020) *Trachypithecus leucocephalus*. In *The IUCN Red List of Threatened Species* 2020. dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T39872A17988378.en.

HUANG, C.M., LI, Y.B., ZHOU, Q.H., FENG, Y.X., CHENG, Z., YU, H. & WU, Z.J. (2008) Karst habitat fragmentation and the conservation of the white-headed langur (*Trachypithecus leucocephalus*) in China. *Primate Conservation*, 23, 133–139.

HUANG, C.M., WEI, F.W., LI, M., QUAN, G.Q. & LI, H.H. (2002) Current status and conservation of white-headed langur (*Trachypithecus leucocephalus*) in China. *Biological Conservation*, 104, 221–225.

LI, Y.B., HUANG, C.M., DING, P., TANG, Z. & WOOD, C. (2007) Dramatic decline of François' langur *Trachypithecus francoisi* in Guangxi Province, China. *Oryx*, 41, 38–43.

LI, Z.Y. (2000) *The socioecology of white-headed langurs,* Presbytis leucocephalus*, and its implications for their conservation*. PhD thesis. University of Edinburgh, Edinburgh, UK.

Li, Z.Y. & Rogers, M.E. (2007) Censusing populations of white-headed langurs on limestone hills: problems and solutions. *Endangered Species Research*, 3, 321–329.

Thinley, P., Norbu, T., Rajaratnam, R., Vernes, K., Wangchuk, K., Choki, K. et al. (2019) Population abundance and distribution of the Endangered golden langur (*Trachypithecus geei*, Khajuria 1956) in Bhutan. *Primates*, 60, 437–448.

Wang, W.R., Qiao, Y., Pan, W.S. & Yao, M. (2017) Low genetic diversity and strong population structure shaped by anthropogenic habitat fragmentation in a Critically Endangered primate, *Trachypithecus leucocephalus*. *Heredity*, 118, 542–553.

Zhou, Q.H. & Huang, C.M. (2021) Advances in ecological research on the limestone langurs in China. *Acta Theriologica Sinica*, 41, 59–70. [In Chinese]