

Short Communication

First Camera Trap based Evidence of Grey Wolf *Canis lupus* in the Hanma National Nature Reserve, Inner Mongolia, China

Hamenya Mpemba¹, Yang Fan¹, Asia Murphy², Bao Heng¹ and Guangshun Jiang^{1,*}

¹Feline Research Center of Chinese State Forestry and Grassland Administration, College of Wildlife Resources, Northeast Forestry University, 26 Hexing Road, Harbin, Heilongjiang 150040, P.R. China

²Department of Ecosystem Science and Management and Huck Institutes of the Life Sciences, Pennsylvania State University, PA, USA

ABSTRACT

As an apex predator, the grey wolf (*Canis lupus*) is an ecologically important species. It is considered an ecologically important species due to its position as an apex predator. Grey wolves survive in a wide range of habitats including deserts, steppe, tundra, shrubs, coniferous and deciduous forests. Grey wolves have a cosmopolitan distribution, mostly found in the northern hemisphere. Due to historical and continued persecution; and reduced prey populations, its current range is restricted to remote areas. Thanks to conservation initiatives, grey wolves are beginning to reclaim parts of its historical distribution, currently listed as Least Concern by the IUCN. During a two year camera-trapping survey, we obtained the first photographic detection of grey wolves in Hanma National Nature Reserve, China. We deployed 113 camera traps spaced at least 1km apart, which ran for 27,607 trap nights. On October 11th 2017 at 16:40, a camera located in the coniferous forest detected two adult grey wolves. Thus, we report the first photographic detection of grey wolves in HNNR. We emphasize the need for more research to further determine the true distribution of grey wolves in China and suggest that wildlife managers can use the same conservation strategies applied in HNNR to other areas in order to assist grey wolf recovery.

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Authors' Contributions

HM and YF designed the experiments and collected data. GJ conceived and contributed to the experiments design. AM advised on the drafting of manuscript. HM wrote the manuscript. BH helped in field survey.

Key words

Grey wolf, Camera trapping, Wild canids, Hanma, Least concern.

The grey wolf (*Canis lupus*; Linnaeus, 1758) is the largest member of the Canidae family (Smith and Xie, 2008) and considered an ecologically important species (Sillero-Zubiri *et al.*, 2004) due to its position as an apex predator (Enkhsaikhan, 2004). Grey wolves can survive in a wide range of habitats, including but not restricted to deserts, shrub land, tundra, steppe, coniferous and deciduous forests (Sillero-Zubiri *et al.*, 2004; Ozoliņš *et al.*, 2008; Lu *et al.*, 2016). Thanks to their generalist natures, grey wolves have a cosmopolitan distribution, historically ranging north of the 15°N latitude in North America and 12°N in India (Sillero-Zubiri *et al.*, 2004; Jdeidi, 2010). Due to past and continued persecution (Boitani and Ciucci, 1995; Enkhsaikhan, 2004), as well as reduced prey populations (Levi and Wilmers, 2012; Ripple *et al.*, 2014), its current range is restricted to remote areas in northern Europe, Asia, and North America. Due to its worldwide distribution and stable population trend, grey wolves are currently listed as least concern (Jdeidi, 2010).

Thanks to conservation initiatives (Chapron *et al.*, 2014; Ripple *et al.*, 2014), grey wolves are beginning to reclaim parts of its historical distribution (Lu *et al.*, 2016). Although Inner Mongolia is part of the grey wolf's range in China (Smith and Xie, 2008; Lu *et al.*, 2016), there hasn't been any current day sightings of wolves in Hanma National Nature Reserve. Occasionally, footprints and scat would be found that were thought to be from grey wolves, and locals believed that the region once had wolves. However, there haven't been any visual sightings confirming the presence of wolves in the area until now. We report the first photographic detection of grey wolves in the greater Khingan Mountains of Hanma National Nature Reserve and call for additional and systematic surveys to determine the full range of grey wolves in China (Lu *et al.*, 2016).

Materials and methods

We obtained the first photographic detection of grey wolves in the greater Khingan Mountains of Hanma National Nature Reserve during a study examining the influence of an apex predator's visual and odor cue on the spatial and behavioral responses of mesopredators

* Corresponding author: jgshun@126.com
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and potential prey species. The Hanma National Nature Reserve, which covers an area of 1,073.5 km², is located in the Jinhe town Inner Mongolia province, China (Fig. 1) (Zhai-Penghui and Zhengshan, 2015). The area is remote, with minimal human presence (Guo *et al.*, 2017), and contains a number of mammalian species such as: roe deer (*Capreolus pygargus*), lynx (*Lynx lynx*), wolverine (*Gulo gulo*), red deer (*Cervus elaphus*), moose (*Alces alces cameloides*), Siberian musk deer (*Moschus moschiferus*), sable (*Martes zibellina*), brown bear (*Ursus arctos*), and mountain hare (*Lepus timidus*) (Zhai-Penghui and Zhengshan, 2015; Guo *et al.*, 2017). Coniferous forest covers approximately 82% of the reserve; other habitat types include deciduous forest, sparse shrub land, and swamps. The mean annual temperature and amount of precipitation is -5.3°C and 450mm, respectively (Guo *et al.*, 2017). In winter, the snow can get up to 30 cm deep.

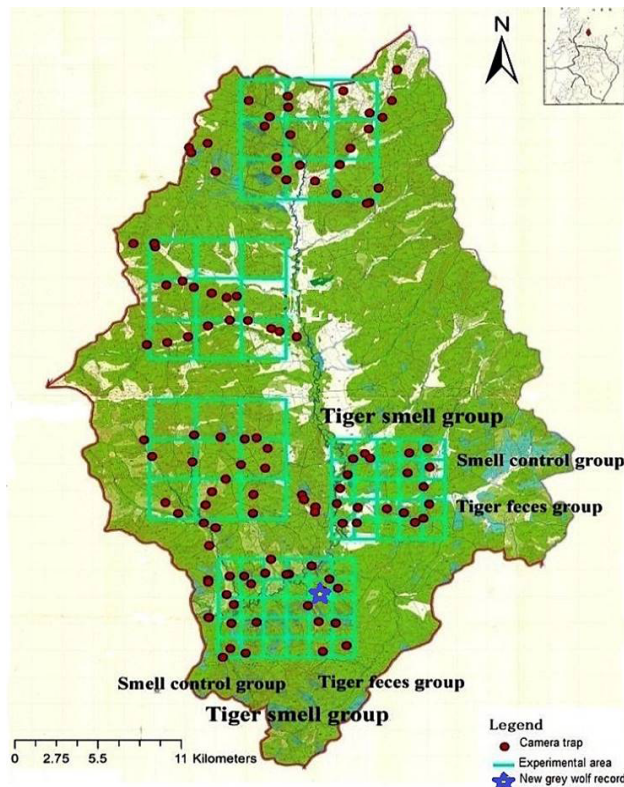


Fig. 1. The map of the study area with camera trap stations and the location of the first camera trap based grey wolf (*Canis lupus*) record in the Hanma National Nature Reserve Jinhe Inner Mongolia province, north China. On the down block (Tiger smell group, sub group Tiger feces group) the black triangle like symbol indicates the camera station that recorded the grey wolf.

We deployed 113 camera traps (Nighthawk

Bestguarder SG-990V infrared sensor trigger self-timer digital camera camera) and the Ltl Acorn scouting camera (Model: Ltl-5210 and Ltl-5210A). Camera traps were spaced at least 1km apart, across approximately 85% of the reserve. We placed camera traps on game trails, near water sources, and other areas where there would be a high possibility of detecting animals (Azevedo *et al.*, 2016) and the cameras were set to record 20-second videos after every 5-second interval once triggered. Cameras were run for 662568 h period beginning in June 2016 and ending in July 2018. Because we were attempting to examine the influence of apex predator presence cues on other species, at each camera station on the tiger feces cue group we included a bottle with Amur tiger (*Panthera tigris altaica*) feces collected from the Siberian Tiger Park in Harbin, China (Qingming, 2007). Also, on the smell control group we had the same bottle filled with soil as control. This bottle was fixed onto a nearby tree within the view of the camera, at approximately 50cm height. The whole experiment is now completed.



Fig. 2. The wolf (*Canis lupus*) individual(s) recorded on 11th October 2017 at the Hanma National Nature Reserve Jinhe Inner Mongolia province, north China. From top left to bottom right: one wolf surveys the environment, and then leaves the camera traps field of vision. Another wolf appears, marks a tree (the blue plastic bottle contains the Amur tiger feces), and then scratches the ground.

Results

On October 11th 2017 at 16:40, a camera located in the coniferous forest detected two adult grey wolves. The first wolf was seen looking ahead for few seconds before walking away (Fig. 2, top two photos). The second wolf was seen marking a nearby tree followed by ground scratching (Sillero-Zubiri *et al.*, 2004).

Discussion

Our study is the most comprehensive and longest-running camera trap survey of the Hanma National Nature Reserve. During the survey, we have heard reports from locals about the presence of grey wolves in the area, but this is the first and only photographic detection of the species within the reserve. It is possible that the lack of previous grey wolf detections in the area is due to the dearth of large-scale wildlife surveys in the area, or that these two wolves have dispersed into the reserve recently (Ballard *et al.*, 1997). The nearest known wolf record is in Shuanghe National Nature Reserve Heilongjiang, China; about 300 km from our study area. There have been significant increases in prey species such as moose and roe deer recently due to minimal disturbance and enforced protection (Guo *et al.*, 2017). We obtained 36 detections of four potential prey species (Fig. 3) at the same location across the two years of the survey. Because wolf distribution can be influenced by prey distribution (Hunter and Barrett, 2011), it is also possible that the wolves were in the area due to the availability of prey.



Fig. 3. Prey species detected at the same location as the wolf, from top left to bottom right: roe deer, red deer, moose, and musk deer.

There are three potential reasons why we saw the territorial marking behavior shown by one of the wolves. The first is that there could be other undetected wolves in the area (Sillero-Zubiri and MacDonald, 1998; Sillero-Zubiri *et al.*, 2004) and the wolf was marking its territory. However, since we didn't obtain another photographic detection of wolves during our two years survey, this is unlikely. Another possible reason that the wolf was marking is due to the presence of the Amur tiger scent (the blue bottle seen in Fig. 2). Amur tiger distribution has never been extant in the reserve, but grey wolves and Amur

tigers are said to show competition in areas where they overlap (Miquelle *et al.*, 2005). Finally, it could simply be because canids tend to mark objects that have foreign scents (Mertl-Millhollen *et al.*, 1986).

Our new record gives us a more comprehensive picture of grey wolf distribution in China (Lu *et al.*, 2016). There has been no systematic, large-scale study on grey wolf distribution in China (Honghai, 1999; Lu *et al.*, 2016). We emphasize that more research should be conducted in this area and surrounding locations to further determine the true distribution of grey wolves in the region. Finally, we recommend that wildlife managers use the same conservation strategies that have been applied in Hanma National Nature Reserve in other areas in order to assist grey wolf recovery in China.

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Statement of conflict of interest

The authors declare that they have no conflict of interests regarding publication of this article.

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