The diminishing status of the Great Bustard *Otis tarda tarda* in Xinjiang province, north-west China

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Summary: The Western Great Bustard *Otis tarda tarda* is restricted in China to Xinjiang province, where its status is little known. Using transect methods, we surveyed three previously reported potential distribution areas, Tacheng, Qapqal and Altay, from 2014 to 2016, and again in 2018. During these surveys, we saw no Great Bustards in Qapqal, the only recorded overwintering area in Xinjiang. We found only four males in Altay during the breeding season, but the survey was limited and needs to be repeated. In Tacheng, we found 17 individuals during the breeding season, and 317–444 individuals from different years before autumn migration. The major threats to the Great Bustard in Xinjiang are habitat loss and nest destruction as a result of human activities. We recommend the establishment of a reserve for Great Bustards in Xinjiang, development of compatible agricultural activities, public awareness campaigns, and continued monitoring.

INTRODUCTION

Both subspecies of Great Bustard, *Otis tarda tarda* and *O. t. dybowskii*, occur in China. The former is found only in the north-west of China, in Xinjiang province, while the latter inhabits north-east China, migrating south to overwinter in the Yangtze and Yellow river basins (Tian & Zhang 2006, Mi *et al* 2016). In comparison to *O. t. dybowskii*, *O. t. tarda* has been little studied in China and its migratory routes are unknown (Gao *et al* 1994, Hu *et al* 1996, Gao 2007).

Historically in Xinjiang, China, the subspecies *O. t. tarda* was thought to use steppe, grassland, desert steppe and farmland habitat, especially near river margins and lakesides, meadows, meadow-grasslands and wheat fields in the Tacheng and Qapqal valleys (Jiang 2004, Gao *et al* 2007). Together, Qapqal and Tacheng have held the highest densities of Great Bustard in the country (Gao *et al* 1994, Hu *et al* 1996). Recently, it was estimated that around 70% of China's *O. t. tarda* population inhabits the Tacheng basin, which was considered to be the largest breeding area of this subspecies in China (Jiang 2004). Qapqal county contained the only recorded wintering area for *O. t. tarda* in Xinjiang, while Tacheng birds are thought to overwinter at unknown sites outside Tacheng (Gao *et al* 1994, 2007). Currently, these two areas, encompassing *c*12 500 km^2, are sparsely occupied by Great Bustards (Wang *et al* 2018; Figure 1).

Traditional agriculture is practised in the areas inhabited by Great Bustards. Two-year rotations are used on small fields of cereal crops, alfalfa and rapeseed. The fields are interspersed with pasture (Wang *et al* 2015a). During the breeding season, Great Bustards are observed primarily in winter wheat and alfalfa, with very few birds in natural steppe habitat. In summer, most Great Bustards are observed in oilseed rape and fewer in alfalfa. During the pre-migratory period, the species mainly uses winter wheat and stubbles from harvested wheat (Wang *et al* 2015a).

Annual average precipitation in Xinjiang is less than 200 mm (Wang *et al* 2015b). Over recent decades, irrigation systems have been widely installed to intensify agricultural production. This presents dangers to breeding Great Bustards such as nest loss to irrigation or to disturbance.

The breeding range of *O. t. tarda* in China is thought to have shrunk to several isolated areas (Jiang 2004, Tian & Zhang 2006), probably hindering gene exchange between populations. Over the past few decades, numbers have declined, seemingly linked to the large-scale conversion of steppe to agricultural land, increasing human disturbance on the

breeding grounds, habitat loss and population isolation on both wintering and breeding grounds (Chan & Goroshko 1998, Gao *et al* 2008).

SURVEYS AND POPULATION ESTIMATE

Late in the last century, researchers conducted surveys and estimated the population of *O. t. tarda* in Xinjiang province to be 2000–3000 birds (Gao *et al* 1994). However, this estimate was criticised as low-quality (Palacín & Alonso 2008). Since those surveys, when 120 birds were counted in Qapqal in 1988 and 119 birds were counted in Tacheng in 1992 (Wang *et al* 2018), the population of *O. t. tarda* in China has rarely been monitored, and citizen science data have also been unavailable. However, our study, which found no birds in Qapqal in 2013–2014 and a maximum of 19 in Tacheng in 2014–2016, suggested that the breeding population had strongly declined from 239 in 1988 and 1992 to 19 (*ie* by 92%; Wang *et al* 2018). We did not identify an obvious lek centre in Tacheng over the course of our work, perhaps because of the very low population size in this area; in 2018 we counted only 17 birds.

Before migration in autumn, the Great Bustards in Tacheng gathered at three sites (near Abudula town, Qiaxia town and 168 Regiment; Table 1, Figure 1). At this time, larger numbers (317–444) were observed than during the breeding season. This difference may reflect difficulties observing these birds on their breeding grounds. Alternatively, the birds seen may have involved migrants moving temporarily into China from adjacent eastern Kazakhstan.

Great Bustards have only been recorded as wintering in one area in Xinjiang, at Qapqal, Ili Kazakh autonomous prefecture. However we failed to find any Great Bustards there during two years of surveys, which suggests either a very low or even extinct population in this former wintering area (Table 2).

Four Great Bustards were observed during survey work in April 2018 in Altay prefecture, Xinjiang (Figure 1). However, surveys were only conducted in this region once, and it is unclear if these individuals were migrating or remained to breed.

Figure 1. Map of the areas used by Great Bustards in Xinjiang, China. * represents breeding and pre-migratory gathering areas. W represents a known wintering site, although the species was not observed there in recent surveys. Δ represents a single spring observation.

Table 1. Expert evaluation of the number of Great Bustards in Tacheng, Xinjiang, based on observations from 2014–2018.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	17	dispersed	4
Summer	2–16	1	3
Gathering for migration	317–444	3	5
Wintering	0	–	2

Table 2. Expert evaluation of the number of Great Bustards in Qapqal, Xinjiang, based on observations from 2013–2014.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	0	–	4
Gathering for migration	0	–	4
Wintering	0	–	4

THREATS TO GREAT BUSTARDS

Both Great Bustard subspecies are currently listed as first-category protected animals in China (Zheng 1994), where habitat loss is definitely the most serious threat to the species. For *O. t. tarda*, over recent decades most of the grasslands within its Chinese range were reclaimed. Most of the habitat for the species within this range is severely fragmented and isolated owing to agricultural intensification and habitat fragmentation caused by human activity.

In these human-modified habitats in Xinjiang a major threat is nest loss: agricultural irrigation is the major cause of breeding failure. Sometimes farmers locate a nest before flooding a field. In some cases, they simply remove the eggs, but in others they attempt to rescue the nest by building a higher embankment for it; however, these nests are almost always abandoned by the female.

As noted above, the small and fragmented nature of the remaining populations of Great Bustard in China represents a threat to the species' genetic diversity. Moreover, as a result of small group sizes, birds spend more time in vigilance behaviours than feeding (Wang *et al* 2016).

We observed several adult Great Bustards with injured legs during our surveys, although the cause of the injury was not clear.

RECOMMENDATIONS FOR CONSERVATION

A stronger understanding of the Great Bustard's ecology in Xinjiang would aid in the species' conservation. A provincial-level survey would further clarify the total number of this species and their exact distribution. Telemetry research could clarify the breeding and wintering grounds of the larger flocks observed in autumn in Tacheng, which could launch flyway-scale collaboration for the conservation of these birds. Research into habitat selection can guide the development of compatible agricultural mosaics, which is particularly important for breeding success.

A nature reserve focused on the Great Bustard should be established in Tacheng, which could regulate human disturbance and establish suitable conditions. Public awareness campaigns about the species and its habitat should be conducted, particularly promoting conservation of nests during the breeding season.

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