

Status of the Western Great Bustard *Otis tarda tarda* in Asia and its significance to an updated estimate of the global population of Great Bustards

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Summary: Although the Western Great Bustard *Otis tarda tarda* was historically abundant in the Eurasian steppes, its populations have suffered declines, extirpations and range fragmentation since the late 19th century. The papers presented in this collection provide geographically comprehensive coverage which enables us to estimate the current population of Western Great Bustards in wider Central Asia, inclusive of Iran and eastwards to Xinjiang, China. A total of 230–418 Western Great Bustards are reported on breeding grounds across this range. The small size of remaining leks and their geographic isolation raise concern about the vulnerability and viability of these populations. On wintering grounds, where Great Bustards gather in larger flocks, up to 500 individuals are counted in one region (Turkistan province, Kazakhstan). Estimated from sources within the last five years, the global population of the Great Bustard is approximately 29 000–32 500 individuals. This estimate is approximately 40% lower than the last global estimate, published in 2014. Although Central Asia occupies 30% of the species' former longitudinal geographic range from Portugal to Primor'e, Russia, the Central Asian population of Great Bustards now represents only 1% of the total global population. Poaching of birds in larger winter flocks, incompatible agricultural practices and predation by free-ranging dogs are serious and widespread threats described by Great Bustard experts across this range. Without rapid action the loss of the Western Great Bustard from additional regions of Asia is likely. These populations will be difficult to re-establish due to their distinct migratory behaviour.

HISTORICAL RANGE

Two centuries ago, the Great Bustard *Otis tarda* was a familiar inhabitant of the Eurasian steppes (Kessler & Smith 2014), with breeding populations established from Portugal to the Pacific coast of Russia. Within Asia, the range of the Western Great Bustard *O. t. tarda* extends from West Azerbaijan province, north-west Iran, eastward to Xinjiang, north-west China. In Asia, the Western Great Bustard breeds as far north as Omsk oblast' along the southern border of western Siberia, Russia, and earlier regularly wintered as far south as North Khorasan, north-eastern Iran. During the 20th century, this Central Asian population crashed catastrophically and its geographic distribution became highly fragmented (review in Kessler & Smith 2014). This paper summarises the data presented in a set of geographically comprehensive articles in this volume, to offer a current snapshot of the distribution and population size of the Western Great Bustard in Asia.

CONTEMPORARY POPULATION ESTIMATES

Breeding population estimate

The Great Bustard is a lekking species, in which groups of individuals gather each spring at discrete, traditional spots in the landscape ('leks'). Great Bustards generally remain on or near their leks during spring months to display, incubate eggs and raise young. This fidelity to breeding grounds allows us to estimate the total Central Asian breeding population by summing the number of individuals reported as present during the breeding season in each region. A total of 230–418 individual Western Great Bustards are recorded on breeding grounds in Asia, according to regional estimates produced from 2017 to 2021 (Table 1).

Most of the breeding populations reported in Asia are now at high risk of disappearance. A study of the dynamics of Western Great Bustard leks in Iberia indicated that the chance

of lek extirpation increases rapidly when the number of birds present is less than thirty (Pinto *et al* 2005). The data presented in Table 1 summarise the total number of Great Bustards breeding in each region, which may geographically encompass more than one lek. Even so, the number of Western Great Bustards reported breeding in any one region is less than thirty in all locations except southern Kazakhstan, eastern Kazakhstan, and Iran.

Migratory flock counts

The migratory habits of the Great Bustard differ longitudinally across its wide range (Kessler *et al* 2013). Within Asia, the remaining population of Great Bustards in Iran makes only short seasonal movements. Elsewhere in Asia, Western Great Bustards are largely migratory, with timing and distance of longer movements dependent on winter weather conditions (Kessler 2015). Even after spending a prolonged period at a winter site, Great Bustards in Central Asia may move further south in response to worsening winter weather, particularly snow cover precluding foraging. These flexible migratory movements make it impracticable to draw conclusions about regional population size by summing counts taken across the migratory range during the migratory and winter periods, unless these counts are tightly synchronised.

On the northernmost Asian breeding grounds (along the southern Russian and northern Kazakhstan border) a few individual Western Great Bustards sometimes remain to overwinter. Southern breeding grounds serve as migratory staging areas or, in mild years, overwintering sites. These sites, in southern and south-eastern Kazakhstan, currently report the largest accumulations of Great Bustards during the migratory period (Table 2).

A comparison of the maximum number of Great Bustards reported at any migratory stopover (Table 2) with the total number of individuals reported as breeding at sites northward on the same flyway (Table 1) finds more birds tallied on stopover in central Kazakhstan and Xinjiang than expected. This discrepancy is likely to be due to a combination of two factors: first, overestimates on wintering grounds, due to the high mobility of these large winter flocks, and, second, underestimates on the breeding grounds, as breeding females are less easily detected in growing vegetation, and some lek sites may not yet have been identified.

Wintering population estimate

In Central Asia, Great Bustards gather in larger flocks during the winter months. Although Turkmenistan was historically the most important region for overwintering Great Bustards in Central Asia, today the regions with the largest overwintering populations are Uzbekistan and southern and eastern Kazakhstan (Table 2). Again, it is inappropriate to sum winter counts that are not synchronised, because, for example, individuals tallied as overwintering in southern Kazakhstan may move suddenly to Uzbekistan if winter weather worsens.

The maximum number of individuals estimated to reach Uzbekistan during harsh winters (500) is roughly equivalent to the total number of breeding individuals estimated in Central Asia. The sum total of Great Bustards breeding in areas which might plausibly migrate to eastern Kazakhstan (a total of 127–173 in eastern, central and northern Kazakhstan, along the southern border of Russia from Omsk to Altai krai, and Xinjiang) is lower than the number reported to overwinter in eastern Kazakhstan (180–500). As described in the previous section, this discrepancy is likely to be due both to double-counting individuals over the course of their migratory movements and to underestimates of breeding populations.

Table 1. Summary of breeding season population estimates of Western Great Bustard *Otis tarda tarda* presented in this collection, which were prepared using identical templates and instructions in preparation for the conference ‘Advancing the Conservation of the Great Bustard in Asia’, held in Ulaanbaatar, Mongolia (with the exception of the estimate for Orenburg oblast’, which is sourced from the regional Red Book). Estimates of population size are provided alongside a count of the number of sites currently used by the species and the author’s level of confidence in the population assessment for that region. Quality of estimates: 1 = low, 5 = high.

Geographic area		Breeding season			Source
Country	Region	Number of individuals	Number of sites	Quality of population estimate (low=1, high=5)	
Iran	Boukan	33–35	4	4	Abdulkarimi 2022
Russia	Orenburg oblast’	‘Fewer than 100’*	Not available	Not available	Kornev & Gavlyuk 2019
Russia	Tyumen’ oblast’	2–6	1	2	Nefedov 2022
Russia	Kurgan oblast’	2–6	Unknown	1	Nefedov 2022
Russia	Omsk oblast’	10–20	25	3	Nefedov 2022
Russia	Novosibirsk oblast’	2–6	1	1	Nefedov 2022
Russia	Altai krai	10–20	3	2	Nefedov 2022
Kazakhstan	North Kazakhstan province	4–10	1	2	Nefedov 2022
Kazakhstan	Pavlodar province	4–10	Unknown	1	Nefedov 2022
Kazakhstan	Western Kazakhstan	5–26	2	2	Kessler & Bidashko 2022
Kazakhstan	Central Kazakhstan	20–30	6	2	Koshkin et al 2022
Kazakhstan	Southern Kazakhstan	50–70	13	4	Shakula et al 2022a
Kazakhstan	Eastern Kazakhstan (including Zaisan**)	60	11	1.5	Shakula et al 2022b
China	Xinjiang	17	Dispersed	4	Wang & Yang 2022
Kyrgyzstan	entire country	1–2	2	1	Kulagin 2022
Tajikistan	entire country	0	0 currently used (4 extirpated)	Not applicable	Muratov & Talbonov 2022
Uzbekistan	entire country	0	0	5	Kashkarov et al 2022
Turkmenistan	entire country	0	0	5	Rustamov 2022
Entirety of Asia		230–418***	>69	Average = 2.5	

*A range of 10–100 is used for the purpose of tallying. **Prokopov 2022 provides estimates for a subsection of this region, the Zaisan depression. ***The final row sums the number of Great Bustards observed in all regions. As estimates are provided for every region in Asia in which this subspecies is reported to persist, these sums represent the entire known extant breeding population of the Western Great Bustard in Asia.

Table 2. Summary of migratory season and winter population estimates of Western Great Bustard *Otis tarda tarda* presented in this collection, which were prepared using identical templates and instructions in preparation for the conference ‘Advancing the Conservation of the Great Bustard in Asia’, held in Ulaanbaatar, Mongolia (with the exception of the estimate for Orenburg oblast’, which is sourced from the regional Red Book). Estimates of population size during the migratory (representing either flocks staging for migration, or on stopover; dependent on geographic area) and winter seasons are provided alongside a count of the number of sites currently used by the species and the author’s level of confidence in the population assessment for that region. Citations are as in Table 1. Quality of estimates: 1 = low, 5 = high.

Geographic area		Migratory season			Winter		
Country	Region	Number of individuals	Number of sites	Quality of population estimate	Number of individuals	Number of sites	Quality of population estimate
Iran	Boukan	Not applicable	Not applicable	Not applicable	35–40	2	4
Russia	Orenburg oblast*	Not available	Not available	Not available	0	0	Not available
Russia	Tyumen' oblast'	3–15	1	2	0	0	Not applicable
Russia	Kurgan oblast'	3–15	Unknown	1	0	0	Not applicable
Russia	Omsk oblast'	9–25	3	2	0	0	1
Russia	Novosibirsk oblast'	3–15	Unknown	1	0	0	1
Russia	Altai krai	9–35	Unknown	2	0	0	1
Kazakhstan	North Kazakhstan province	9–35	Unknown	1	0	0	1
Kazakhstan	Pavlodar province	9–35	Unknown	1	0	0	1
Kazakhstan	Western Kazakhstan	20–40	3	2	0	0	2
Kazakhstan	Central Kazakhstan	80–100	21	3	Not applicable	Not applicable	Not applicable
Kazakhstan	Southern Kazakhstan	180–200	6	2	400–500	12	4
Kazakhstan	Eastern Kazakhstan (including Zaisan*)	80–90	14	4	180–500	15	5
China	Xinjiang	317–444	3	5	0	0	2
Kyrgyzstan	entire country	4–10	3	3	2–5	2	3
Tajikistan	entire country	1–5	4	3	1–2	1	2
Uzbekistan	entire country	10–30	3	1	50–70 to 200–500**	6	3
Turkmenistan	entire country	Up to 75, but some regions not surveyed	Sites across four ecoregions	2–4 (depending on region)	25–45	Sites across two ecoregions	2–5 (depending on region)
Entirety of Asia		Not applicable***	>61	Average=2.3	Approximately 500–1200***	>38	Average=2.4

*Prokopov 2022 provides estimates for a subsection of this region, the Zaisan depression. **First range of numbers represents the number of Great Bustards observed during a mild winter; the second range represents the number observed during a severe winter.

***The final row sums the number of Great Bustards observed in all regions. As estimates are provided for every region in Asia in which this subspecies is reported to persist, these sums represent the entire known extant population of the Western Great Bustard in Asia. Due to the likelihood of duplicate counts during migration, a sum cannot be produced for the migratory period. Similarly, the winter sum must be interpreted with caution. Refer to the text for interpretation of these totals.

Table 3. Updated global population estimate for the Great Bustard, calculated using the most recent data available, presented from west to east.

Region	Breeding population estimate	Subspecies	Percentage of global total	Reference
Portugal	320 ('160 pairs')	Western	1%	Instituto da Conservação da Natureza e das Florestas and Liga para a Proteção da Natureza 2018 (unpublished data)
Spain	22 000–24 000	Western	74–76%	Palacín & Alonso 2021
United Kingdom (reintroduced)	67	Western	< 1%	Great Bustard Group 2021
Central Europe	2444	Western	8%	LIFE Great Bustard 2022
Morocco	45–50	Western	< 1%	IUCN & HCEFLCD 2016
Ukrainian mainland	75–150*	Western	< 1%	Andryushchenko 2009, Beskaravainyi 2015
Crimea	150**	Western	< 1%	Beskaravainyi 2015
European Russia	'Not more than' 1870	Western	6%	Oparina & Oparin 2021
Turkey	559–780	Western	2%	Özgencil <i>et al</i> 2021
Central Asia (incl Iran, western Siberia, and Xinjiang)	230–418	Western	1%	Table 1 of this article
East Asia (including eastern Siberia)	1300–2200	Eastern	4–7%	Kessler <i>et al</i> 2021
Global Total	29 060–32 449	Both	100%	

*Population for Ukraine inclusive of Crimea was given as 150–200 nesting females in 2009 (Andryushchenko 2009). Fide Y Andryushchenko currently 3–5 females nest in the south of Kherson oblast'. Population size in Mykolaiv and Zaporizhzhia oblast's, where the species was noted as nesting in 2009, is currently unknown. Beskaravainyi (2015) gives the breeding population in Crimea alone as 100 breeding females. If the population in both Crimea and mainland Ukraine remained stable since 2009, this would imply 50–100 breeding females currently in mainland Ukraine. Using a ratio of 2 females per 1 male provides an estimate of 75–150 for mainland Ukraine.

**Calculated from 100 breeding females, using a ratio of 2 females per 1 male.

Overall population estimate

Which seasonal counts are more reliable for the purposes of estimating a total population size for the Great Bustard in Central Asia? Authors reported the quality of their estimates of breeding, migration, and wintering populations roughly equally, and of moderate quality, with averages of 2.3 (migration) to 2.5 (breeding season) on a scale of 1 to 5. Thus, the population of Western Great Bustards in Asia may be as low as 230 individuals (the lower range of the estimate of the breeding population) or as high as 500 (the highest estimate given for an overwintering Great Bustard population). However, even the highest estimate for this population is a cause for concern, given the observed extent of decline in this region. These remaining Great Bustards are splintered into small and discrete breeding populations scattered across a west–east distance of approximately 3000 km, raising concerns about genetic connectivity and lek persistence.

THREATS

Poaching is described as a critical threat to Great Bustards in all regions of Central Asia, with the exception of Iran and Xinjiang, China. Larger wintering flocks of this species are more noticeable, and their destruction by poachers can deal a fatal blow to the

small breeding populations from which these birds originate. Habitat conversion and incompatible agricultural practices are the second-most frequently mentioned threat in this collection of articles. Clutches and broods are destroyed by agricultural machinery, irrigation and livestock trampling, and food resources vital for rapid chick growth are limited by pesticide use. The role of predators in reducing Great Bustard populations, particularly free-ranging domestic dogs, is highlighted in approximately half of the papers presented in this volume. The cumulative impact of these threats is to increase adult mortality while further reducing the naturally low reproductive rate of this species.

CONSERVATION OUTLOOK AND PRIORITIES

A sum of the most recent data available provides a global estimate of roughly 29 000 to 32 500 Great Bustards (Table 3), which is approximately 40% lower than the last global estimate, made in 2014 (Alonso 2014). The range of the Great Bustard historically stretched from Portugal to Primor'e, Russia. Although Central Asia occupies 30% of this longitudinal distance, the number of Great Bustards observed in the region now represents only 1% of the global population of the species (Table 3). In comparative perspective, this wider Central Asia population is now calculated to be approximately five times smaller than that in Central Europe, despite the much larger extent of suitable habitat in Central Asia (Scholtz & Twidwell 2022).

The number of sites used by the Western Great Bustard in each subregion of Asia is generally low. Although this is an indicator of the severity of the species' decline, it provides an opportunity to focus conservation resources effectively at the regional level. Among regions, particular conservation attention should be placed on southern Kazakhstan, as it hosts populations of Great Bustards during all seasons, and most remaining migratory pathways for the Great Bustard in Central Asia pass through this region (Shakula *et al* 2022). Uzbekistan is also a region of high priority for action, as it hosts most of the Asian population of Western Great Bustards during colder winters (Kashkarov *et al* 2022).

While the entire Asian population of Western Great Bustards is at risk, certain populations emerge as particularly vulnerable to extinction. The disjunct population of Great Bustards in Iran makes only small seasonal movements and is spatially widely separated from other populations of Great Bustards, making recolonisation unlikely in the event of extirpation (Abdulkarimi 2022). Additionally, Great Bustards breeding in Orenburg, Russia, and western Kazakhstan are likely to represent the last populations utilizing the eastern Caspian flyway, which terminates in western Turkmenistan and north-eastern Iran (Kessler & Bidashko 2022). In previous centuries, this flyway was seemingly the most heavily travelled by Great Bustards in Asia (Kessler & Smith 2014), but few individuals are now observed. Should the breeding populations in Orenburg and western Kazakhstan be extirpated, re-establishing this migratory route may prove difficult, particularly as a genetic link is associated with the direction of migratory behaviour in bustards (Burnside *et al* 2020).

While specific conservation activities tailored to local circumstances are provided by the authors of each paper in this volume, it is clear that action must also be coordinated at the international level. For this reason, a *Concerted Action for Great Bustards in Asia* was proposed and unanimously approved by Parties to the Convention on Migratory Species (CMS) (Government of Mongolia *et al* 2017, Convention on Migratory Species 2020). In the context of CMS, a Concerted Action provides structure for international cooperation for the conservation of species, as well as a timeline for completion of agreed conservation actions. This has increased international communication about this species. However, financial resources for immediate conservation actions outlined in these proceedings

are urgently required to prevent further and perhaps irreparable declines in these populations, and the disappearance of a steppe icon from the historical heart of its range.

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